

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF	PAGES
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2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. <i>(If applicable)</i>
6. ISSUED BY	CODE	7. ADMINISTERED BY <i>(If other than Item 6)</i>	CODE

8. NAME AND ADDRESS OF CONTRACTOR <i>(No., street, county, State and ZIP Code)</i>	(X)	9A. AMENDMENT OF SOLICIATION NO.
		9B. DATED <i>(SEE ITEM 11)</i>
		10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED <i>(SEE ITEM 11)</i>
CODE		FACILITY CODE

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers is extended, is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: <i>(Specify authority)</i> THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES <i>(such as changes in paying office, appropriation date, etc.)</i> SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER <i>(Specify type of modification and authority)</i>

E. IMPORTANT: Contractor is not, is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION *(Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER <i>(Type or print)</i>	16A. NAME AND TITLE OF CONTRACTING OFFICER <i>(Type or print)</i>
15B. CONTRACTOR/OFFEROR	16B. UNITED STATES OF AMERICA
15C. DATE SIGNED	16C. DATE SIGNED
<i>(Signature of person authorized to sign)</i>	<i>(Signature of Contracting Officer)</i>

Item 14. Continued.

CHANGES TO BID OPENING DATE

1. Standard Form 1442, First Page,

(a) Item No. 12.B.- Insert "10 days" in this box.

(b) Item No. 13.A.- In the second line, change the bid opening date and time from "28 May 2003 at 2 p.m. local time" to "**12 June 2003 at 2 p.m. local time**".

Note: A revised standard form 1442 is issued with this amendment reflecting these changes.

Note: An award is anticipated by June 30. All large businesses be aware that the apparent low bidder will be directed to submit a Subcontracting Plan five days after bid opening.

CHANGES TO THE BIDDING SCHEDULE

2. Replace the Bidding Schedule with the accompanying new Bidding Schedule, bearing the notation "ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-03-B-0001"

CHANGES TO THE SPECIFICATIONS

3. Replacement Sections - Replace the following sections with the accompanying new sections of the same number and title, bearing the notation "ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-03-B-0001:"

SECTION 00100	BIDDING SCHEDULE/INSTRUCTIONS TO BIDDERS
SECTION 01368	SPECIAL PROJECT PROCEDURES FOR FORT HOOD
SECTION 01770	CONTRACT CLOSEOUT
SECTION 04200A	MASONRY
SECTION 07413A	METAL SIDING
SECTION 07416A	STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
SECTION 08520A	ALUMINUM WINDOWS
SECTION 09915	COLOR SCHEDULE
SECTION 13815	AUTOMATED METER READING SYSTEM
SECTION 16311A	MAIN ELECTRIC SWITCHING STATION AND SUBSTATION

CHANGES TO THE DRAWINGS

4. Write-in Change to Drawing A-A104, Elevation 6 – Change "10 mailboxes" to read "**12 mailboxes.**"

5. Replacement Drawings - Replace the drawings listed below with the attached new drawings of the same number, bearing the notation "AM #0001".

G202.cal	G202	INDEX SHEET (VOLUME ONE OF FOUR)
A-I601.cal	A-I601	ROOM FINISH SCHEDULE
G204.cal	G204	INDEX SHEET (VOLUME TWO OF FOUR)
A-E601.cal	A-E601	TELECOMMUNICATIONS RISER DIAGRAM
B-I501.cal	B-I501	SIGNAGE DETAILS
B-I601.cal	B-I601	ROOM FINISH SCHEDULE
B-S201.cal	B-S201	PARTIAL FOUNDATION PLAN - ZONE B1 & B4

B-S302.cal	B-S302	FOUNDATION SECTIONS II
B-E401.cal	B-E401	COMMO PLAN ZONES B1 & B4 FIRST FLOOR
B-E402.cal	B-E402	COMMO PLAN ZONES B2 & B3 FIRT FLOOR
B-E403.cal	B-E403	COMMO PLAN ZONES B1 & B4 2ND & 3RD FLOORS
B-E404.cal	B-E404	COMMO PLAN ZONES B2 & B3 2ND & 3RD FLOORS
B-E601.cal	B-E601	COMMUNICATIONS RISER DIAGRAM
C-A101.cal	C-A101	OVERALL 4 AND 6 UNIT FLOOR PLANS
C-A102.cal	C-A102	TYPICAL UNIT FLOOR PLAN
C-A405.cal	C-A405	ENLARGED PLAN I
C-A502.cal	C-A502	MISCELLANEOUS DETAILS I
C-I501.cal	C-I501	SIGNAGE DETAILS
C-P101.cal	C-P101	PLUMBING LEGEND & SCHEDULES
C-P202.cal	C-P202	PLUMBING FLOOR PLAN - TYPICAL UNITS
C-P501.cal	C-P501	LARGE SCALE PLUMBING FLOOR PLAN
C-P601.cal	C-P601	PLUMBING RISER DIAGRAMS AND DETAIL
C-E601.cal	C-E601	COMMUNICATIONS RISER DIAGRAM
C-F201.cal	C-F201	COMPANY OPERATION BUILDING TYPICAL UNIT LIFE SAFETY PLAN
E-S101.cal	E-S101	STRUCTURAL NOTES & MISCELLANEOUS DETAILS
E-E301.cal	E-E301	POWER & COMMO PLAN
E-E601.cal	E-E601	POWER & COMMO RISER DIAGRAMS
E-E701.cal	E-E701	PANEL SCHEDULES
G208.cal	G208	INDEX SHEET (VOLUME FOUR OF FOUR)
D-A101.cal	D-A101	FLOOR PLAN AND ELEVATIONS
D-A102.cal	D-A102	SWITCHING STATION FLOOR PLAN AND ELEVATIONS
D-S202.cal	D-S202	DISTRIBUTION BAY FOUNDATION PLAN
D-S701.cal	D-S701	FRAMING SECTIONS & DETAILS I
D-U3001.cal	D-U3001	SUBSTATION ELECTRICAL LAYOUT PLAN 1
D-U3002.cal	D-U3002	SUBSTATION ELECTRICAL LAYOUT PLAN 2
D-U3003.cal	D-U3003	SUBSTATION ELECTRICAL UTILITIES PLAN 1
D-U3014.cal	D-U3014	SUBSTATION ELECTRICAL UTILITIES PLAN 12
D-U3023.cal	D-U3023	SUBSTATION ELECTRICAL UTILITIES PLAN21
D-U3026.cal	D-U3026	SUBSTATION ELECTRICAL UTILITIES PLAN 24
D-U3028.cal	D-U3028	SUBSTATION ELECTRICAL UTILITIES PLAN 26
D-U3029.cal	D-U3029	SUBSTATION ELECTRICAL UTILITIES PLAN 27
D-U3031.cal	D-U3031	SUBSTATION ELECTRICAL UTILITIES PLAN 29
D-U3032.cal	D-U3032	SUBSTATION ELECTRICAL UTILITIES PLAN 30
D-U3033.cal	D-U3033	SUBSTATION ELECTRICAL UTILITIES PLAN 31
D-U3035.cal	D-U3035	SUBSTATION ELECTRICAL UTILITIES PLAN 33
D-U3036.cal	D-U3036	SUBSTATION ELECTRICAL UTILITIES PLAN 34
D-U3037.cal	D-U3037	SUBSTATION ELECTRICAL UTILITIES PLAN 35
D-U3038.cal	D-U3038	SUBSTATION ELECTRICAL UTILITIES PLAN 36
D-U3039.cal	D-U3039	SUBSTATION ELECTRICAL UTILITIES PLAN 37
D-U3040.cal	D-U3040	SUBSTATION ELECTRICAL UTILITIES PLAN 38
D-U3044.cal	D-U3044	SUBSTATION ELECTRICAL UTILITIES PLAN 42
D-U3046.cal	D-U3046	SUBSTATION ELECTRICAL UTILITIES PLAN 44
D-U3048.cal	D-U3048	SUBSTATION ELECTRICAL UTILITIES PLAN 46
D-U3050.cal	D-U3050	SUBSTATION ELECTRICAL UTILITIES PLAN 48
D-U3052.cal	D-U3052	SUBSTATION ELECTRICAL UTILITIES PLANn 50
D-U3053.cal	D-U3053	SUBSTATION ELECTRICAL UTILITIES PLAN 51
D-U3054.cal	D-U3054	SUBSTATION ELECTRICAL UTILITIES PLAN 52
D-U3055.cal	D-U3055	SUBSTATION ELECTRICAL UTILITIES PLAN 53
D-U3059.cal	D-U3059	SUBSTATION ELECTRICAL UTILITIES PLAN 57
D-U3061.cal	D-U3061	SUBSTATION ELECTRICAL UTILITIES PLAN 59
D-U3063.cal	D-U3063	SUBSTATION ELECTRICAL UTILITIES PLAN 61

D-U3064.cal	D-U3064	SUBSTATION ELECTRICAL UTILITIES PLAN 62
D-U3067.cal	D-U3067	SUBSTATION ELECTRICAL UTILITIES PLAN 65
D-U3070.cal	D-U3070	SUBSTATION ELECTRICAL UTILITIES PLAN 68
D-U3072.cal	D-U3072	SWITCHING STATION LAYOUT PLAN
D-U6001.cal	D-U6001	SUBSTATION & SWITCHING STATION ONE-LINE DIAGRAM 1
D-U6002.cal	D-U6002	SUBSTATION & SWITCHING STATION ONE-LINE DIAGRAM 2
D-U7001.cal	D-U7001	SUBSTATION SCHEDULES AND MATERIAL LIST
D-E201.cal	D-E201	SUBSTATION & SWITCHING STATION BUILDINGS LIGHTING PLANS & DETAILS
D-E301.cal	D-E301	SUBSTATION & SWITCHING STATION BUILDINGS POWER PLANS & PANEL SCHEDULES
D-E401.cal	D-E401	SUBSTATION & SWITCHING STATION BUILDINGS COMMUNICATIONS PLANS & RISER
D-E801.cal	D-E801	SUBSTATION & SWITCHING STATION BUILDINGS GROUDING DETAILS

6. New Drawings - The new drawings listed below which accompany this amendment, bearing the notation "AM #0001" shall be added to and become a part of the contract documents:

G209.cal	G209	INDEX SHEET CONTINUATION (VOLUME FOUR OF FOUR)
D-E802.cal	D-E802	SUBSTATION & SWITCHING STATION RELAY & CONTROL PANEL DETAILS

END OF AMENDMENT

SOLICITATION, OFFER, AND AWARD <i>(Construction, Alteration, or Repair)</i>	1. SOLICITATION NUMBER	2. TYPE OF SOLICITATION <input type="checkbox"/> SEALED BID (IFB) <input type="checkbox"/> NEGOTIATED (RFP)	3. DATE ISSUED	PAGE OF PAGES
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IMPORTANT - The "offer" section on the reverse must be fully completed by the offeror.

4. CONTRACT NUMBER	5. REQUISITION/PURCHASE REQUEST NUMBER	6. PROJECT NUMBER
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7. ISSUED BY	CODE	8. ADDRESS OFFER TO
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9. FOR INFORMATION CALL	A. NAME	B. TELEPHONE NUMBER <i>(Include area code) (NO COLLECT CALLS)</i>
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SOLICITATION

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

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS *(Title, identifying number, date):*

11. The Contractor shall begin performance within _____ calendar days and complete it within _____ calendar days after receiving
 award, notice to proceed. This performance period is mandatory, negotiable. *(See _____ .)*

12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE PAYMENT BONDS? <i>(If "YES," indicate within how many calendar days after award in Item 12B.)</i> <input type="checkbox"/> YES <input type="checkbox"/> NO	12B. CALENDAR DAYS
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13. ADDITIONAL SOLICITATION REQUIREMENTS:

- A. Sealed offers in original and _____ copies to perform the work required are due at the place specified in Item 8 by _____ *(hour)* local time _____ *(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 is, is not required.
- C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.
- D. Offers providing less than _____ calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER (Must be fully completed by offeror)

14. NAME AND ADDRESS OF OFFEROR (Include ZIP Code)		15. TELEPHONE NUMBER (Include area code)
		16. REMITTANCE ADDRESS (Include only if different than Item 14)
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 or greater than the minimum requirement stated in 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)

AMOUNTS 

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
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AWARD (To be completed by Government)

21. ITEMS ACCEPTED

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA
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24. SUBMIT INVOICES TO ADDRESS SHOWN IN  (4 copies unless otherwise specified)	ITEM	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO <input type="checkbox"/> 10 U.S.C. 2304(c) () <input type="checkbox"/> 41 U.S.C. 253(c) ()
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26. ADMINISTERED BY CODE	27. PAYMENT WILL BE MADE BY
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CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

<input type="checkbox"/> 28. NEGOTIATED AGREEMENT (Contractor is required to sign this document and return _____ copies to the 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 contract 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.	<input type="checkbox"/> 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.
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30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Type or print)	31A. NAME OF CONTRACTING OFFICER (Type or print)		
30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA BY	31C. AWARD DATE

Enlisted Barracks Complex III (Project)
Fort Hood, Texas (Location)

Solicitation No. DACA63-03-B-0001

BIDDING SCHEDULE
 (to be attached to SF 1442)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
BASE BID: All work required by the plans and specifications for the construction of the Enlisted Barracks Complex <u>excluding</u> all Options.					
0001	Barracks Buildings; complete (Including all utilities to the 1524mm (5-Ft) line exclusive of all work listed separately)	Job	Sum	***	\$_____
0002	Soldier Community Building complete (Including all utilities to the 1524mm (5-Ft) line exclusive of all work listed separately)	Job	Sum	***	\$_____
0003	Ten Company Operations Buildings, complete (Including all utilities to the 1524mm (5-Ft) line exclusive of all work listed separately)	Job	Sum	***	\$_____
0004	Central Plant, complete (Including all utilities to the 1524mm (5-Ft) line exclusive of all work listed separately)	Job	Sum	***	\$_____
0005	Substation, complete (Excluding work required by the design/build items shown in Bid Item 0009).	Job	Sum	***	\$_____
0006	Switching Station, complete (Excluding work required by the design/build items shown in Bid Item 0009)	Job	Sum	***	\$_____
0007	Drilled Piers (excluding piers for design/build items)				
0007AA	460mm (18-In) Drilled Piers	1,761.3	M	\$_____	\$_____
0007AB	460mm (18-In) Casing	624.7	M	\$_____	\$_____

BIDDING SCHEDULE (cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
0007AC	610mm (24-In) Drilled Piers	969.8	M	\$_____	\$_____
0007AD	610(24-In) Casing	326.4	M	\$_____	\$_____
0007AE	762mm (30-In) Drilled Piers	274.0	M	\$_____	\$_____
0007AF	762mm (30-In) Casing	82.2	M	\$_____	\$_____
0007AG	915mm (36-In) Drilled Piers	546.9	M	\$_____	\$_____
0007AH	915mm (36-In) Casing	182.1	M	\$_____	\$_____
0007AI	1067mm (42-In) Drilled Piers	128.5	M	\$_____	\$_____
0007AJ	1067mm (42-In) Casing	42.8	M	\$_____	\$_____
0008	All work to design and construct the road to the Switching Station	Job	Sum	***	\$_____
0009	All work to design and construct the poles, foundations and lines from the Substation to the Switch Station; and structures and foundations within the substation and switch station as required by specification section 16311.	Job	Sum	***	\$_____
0010	All Exterior Work outside the buildings' 1524mm (5-Ft) line (Including of all utilities, earthwork, paving sidewalk, curb and gutter, demolition, turfing, pavilions and all other work not listed separately	Job	Sum	***	\$_____
0011	Mobilization & Demobilization	Job	Sum	***	\$_____
0012	Final Record Drawings	Job	Sum	***	\$ 100,000.00
0013	Operation & Maintenance Manuals	Job	Sum	***	\$ 100,000.00

(Am#1)

0014 The monetary value for all warranty work (base bid and exercised options), which will be retained by the Government during the warranty period as set forth in the Contract, is established at 1 percent of the amount awarded for construction. This is the amount the Government will charge to or withhold from the Contractor to ensure that the Contractor performs the construction warranty within the timeframes specified under Contract Specifications Section 01770 CONTRACT CLOSEOUT, paragraph "Contractor's Response to Construction Warranty Service Requirements." In preparing the contract

BIDDING SCHEDULE (cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
<p><u>schedule, the Contractor shall create a work activity subsequent to Project Transfer. This activity shall be for a period of 365 days, be valued at 1 percent of the amount awarded for construction, and shall be allocated against CLIN 0001. Payment of this activity will be pursuant to Section 01770 CONTRACT CLOSEOUT. The Government's award of this line item does not entitle the Contractor to any additional compensation.</u></p>					
		***	***	***	*****

TOTAL BASE BID \$ _____

0015 Option No. 1: All work required by the plans and specifications for the construction of the 15KV "MW1" and associated poles and hardware including 15kv circuit breaker.

Job Sum *** \$ _____

0016 Option No. 2: All work required by the plans and specifications for the construction of the 15KV line "MW8" and associated poles and hardware and demolition of line and poles as indicated on the plans including 15kv circuit breaker.

Job Sum *** \$ _____

TOTAL BASE BIB PLUS OPTIONS 1 & 2 \$ _____

BIDDING SCHEDULE (cont)

NOTES:

1. ARITHMETIC DISCREPANCIES: (1989 JUL)

(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 bidders:

(1) Obviously misplaced decimal points will be corrected;

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

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

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

(b) For the purposes of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, extensions, and totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids. (EFARS 14.406-2)

2. If a modification to a bid based on unit prices is submitted, which provides for a lump sum adjustment to the total estimated cost, the application of the lump sum adjustment to each unit price in the bid 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 unit price in the bid schedule.

3. Bidders must bid on all items.

4. Costs attributable to Division 01 - General Requirements are assumed to be prorated among bid items listed.

5. Responders are advised that this requirement may be delayed, canceled or revised at any time during the solicitation, selection, evaluation, negotiation and/or final award process based on decisions related to DOD changes in force structure and disposition of the Armed Services.

6. For the purpose of this solicitation, the word "item" shall be considered to mean "schedule" as used in Provision 52,214-0019, CONTRACT AWARD--SEALED BIDDING--CONSTRUCTION, in Section 00100 INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS, excluding additives, deductives or options

7 EVALUATION OF OPTIONS (JUL 1990) (FAR 52.217-5)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

BIDDING SCHEDULE (cont)

8 OPTION FOR INCREASED QUANTITY - SEPARATELY PRICED LINE ITEM (MAR 1998)
(FAR 52.217-7)

The Government may require the completion of the numbered line item, identified in the Bidding Schedule as an option item, in the quantity and at the price stated in the Bidding Schedule. The Contracting Officer may exercise the option by written notice to the Contractor within the period specified in the Bidding Schedule. Completion of added items shall continue at the same schedule as the Base Bid unless otherwise noted in the SPECIAL CONTRACT REQUIREMENTS, paragraph 1 entitled COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK.

9. The Government reserves the right to exercise the option(s) either singularly or in any combination for up to 90 calendar days after award of the Base Bid without an increase in the Offeror's Bid Price.

10. ABBREVIATIONS

mm	millimeter
M	meter
In	inch
Ft	foot

END OF BIDDING SCHEDULE

**SECTION 00100
BIDDING SCHEDULE/INSTRUCTIONS TO BIDDERS**

LOCAL INSTRUCTION

PROJECT INFORMATION

- a. For technical information regarding plans and specifications contact John Oblak, Fort Worth District Office, Corps of Engineers, Fort Worth, Texas, telephone, via telephone (817)886-1754; via e-mail: john.s.oblak@swf02.usace.army.mil
- b. For information regarding bidding procedures or bonds, contact Ruby Oringderff via telephone (817) 886-1061; via email ruby.j.oringderff@swf02.usace.army.mil; or visit Room 2A19, 819 Taylor Street, Fort Worth, Texas. Collect calls not accepted.
- c. Bids will be publicly opened, at the time and date stated in the solicitation, in Room 2A20, 819 Taylor Street, Fort Worth, Texas.
- d. Hand Carried Bids: Hand carried bids prior to 30 minutes before bid opening must be deposited in the "Bid Depository," Room 2A19, 819 Taylor Street, Fort Worth, Texas. Hand carried bids within 30 minutes of the stated bid opening time should be taken to the Bid Opening Room, Room 2A20, prior to the time stated for bid opening.

GENERAL NOTICES

- a. 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 USC 1001. (FAR 52.214-4)
- b. The Affirmative Action Requirement of the Equal Opportunity Clause may apply to any contract resulting from this IFB.

FACSIMILE BIDS

The fax number listed in the provision 52.214-31, Facsimile Bids, is available for use by all bidders and offerors on a "first come, first served" basis and is, therefore, subject to heavy use for long periods of time. Accordingly, bidders are cautioned that "last minute" bids may be received late due to heavy message traffic. The government assumes no responsibility for such late bids.

BID GUARANTEE

Reference the provision 52.228-1, Bid Guarantee. Facsimile Bonds are not acceptable. **NOTE:** Based on GAO decision (B-291166.2, December 6, 2002), a bid bond with only computer generated signatures, and there is not a signature affixed to the document after the computer generation, must be rejected due to the absence of a valid signature.

BIDDER'S QUALIFICATIONS

Pursuant to FAR 9.1, before a bid is considered for award, the bidder will be requested by the Government to submit a statement regarding his previous experience in performing comparable work, his business and technical organization, financial resources, and plant available to be used in performing the work.

NOTICE REGARDING POTENTIAL EMPLOYMENT ON MILITARY INSTALLATION

If the work called for by this request for proposal is located on a military installation, offerors should check with post/base security to determine if potential employees will be allowed on the base/post to seek employment.

SMALL BUSINESS SUBCONTRACTING PLAN

- a. This notice applies to Large Businesses only.
- b. Reference FAR 52.219-9, SMALL BUSINESS SUBCONTRACTING PLAN. The bidder/offeror shall take into consideration only those subcontracts that he/she will award when preparing the subcontracting plan required by the FAR.
- c. The Contracting Officer will NOT make award under this solicitation without an APPROVED subcontracting plan.
- d. To be approved, the plan must contain at a minimum, the eleven elements set forth in FAR 52.219-9, paragraph (d). Pursuant to AFARS 19.705-4(d), your plan will be reviewed and scored in accordance with AFARS Appendix DD to ensure it clearly represents your firm's ability to carry out the terms and conditions set forth in the contract clauses. AFARS Appendix DD (pages 199 - 205) may be accessed via the Internet at http://farsite.hill.af.mil/reghtml/regs/other/afars/APDD.htm#P13_1130 (AM #1)
- e. Subcontracting Plan Floors. These are the minimum percentages of subcontracted dollars that will be approved. The current floors for Fiscal Year 2003 are as follows:

Small Business	57.2%
Small Disadvantages Business	8.9%
Women-Owned Small Business	8.1%
Service-Disabled Veteran-Owned Small Business	3.0%
HUBZone Small Business	3.0%

- f. Current copies of Standard Form 294 and 295 can be found at [http://contacts.gsa.gov/webforms.nsf/\(formslist\)?openform&count=1000&category=Standard+Forms&expandview](http://contacts.gsa.gov/webforms.nsf/(formslist)?openform&count=1000&category=Standard+Forms&expandview).
- g. Contractors may post subcontracting opportunities at the Small Business Administration's SubNet: <http://web.sba.gov/subnet/index.cfm>.

AMENDMENTS TO THIS INVITATION FOR BIDS (IFB)

Pursuant to FAR 14.208, 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 receipt of bids. Such revisions and amendments, if any, will be announced by an amendment or amendments to this solicitation. If revisions and amendments are of a nature, which requires material changes in quantities or bid prices or both, the date set for opening of 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 of bids.

All amendments to this solicitation will be made through the use of the Internet. No additional media (CD ROMS, Floppy Disks, Faxes, or paper) will be provided unless the Government determines that it is necessary. Contractors may view/download this solicitation and all amendments from the Internet after solicitation issuance at the following Internet address: <https://ebs.swf.usace.army.mil/ebs/AdvertisedSolicitations.asp>. All offerors are required to check the Ft. Worth District Contracting Division website daily to be notified of any changes to this solicitation.

ESTIMATED CONSTRUCTION COST

The estimated cost of the proposed construction is between \$25,000,000.00 and \$50,000,000.00.

SPECIAL NOTICE CONCERNING INDIVIDUAL SURETIES

The Security interest, including pledged assets as set forth in the contract clause 52.228-11, PLEDGES OF ASSETS, and executed Standard Form 28 entitled "AFFIDAVIT OF INDIVIDUAL SURETY" shall be furnished with the bond. Failure to provide with the bid bond a pledge of assets (security interest) in accordance with FAR 28.203-1 will result in rejection of a bid that is bonded by individual sureties.

NOTIFICATION OF UNSUCCESSFUL BIDDERS

a. Federal Acquisition Regulation (FAR) Subpart 14.409-1, Award of Unclassified Contracts, requires that the contracting officer notify each unsuccessful bidder in writing or electronically within three days after contract award.

b. This provision serves as your notice that the Ft. Worth District will post all contract award information for this solicitation electronically on the Fort Worth District Contracting Division Home Page located at <https://ebs.swf.usace.army.mil/ebs/AdvertisedSolicitations.asp>. All bidders are required to review this page daily after bid opening for award information. We will not issue unsuccessful bidder letters in writing.

PARTNERING

In order to accomplish this contract, the government is encouraging the formation of a cohesive partnership with the contractor and its subcontractors. This partnership would strive to draw on the strengths of each organization in an effort to achieve a quality project done right the first time, within budget, and on schedule. This partnership would be bilateral in make-up and participation would be totally voluntary. Any cost associated with effectuating this partnership will be agreed to by both parties and will be shared equally with no change in contract price.

PRINCIPAL CONTRACTING OFFICER

The Contracting Officer who signs this contract will be the Principal Contracting Officer for this contract. However, any Contracting Officer assigned to the Fort Worth District, contracting within his or her authority, may take formal action on this contract when a contract action needs to be taken and the Principal Contracting Officer is unavailable.

PERFORMANCE OF WORK BY CONTRACTOR

The successful bidder/offeror must furnish the Contracting Officer within 20 days after award the following a description of the work which he intends to perform with his own organization (e.g., earthwork, paving, brickwork, or roofing), the percentage of the total work this represents, and the estimated cost thereof.

FAR PROVISIONS

52.204-6 DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (JUN 99)

(a) The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" followed by the DUNS number that identifies the offeror's name and address exactly as stated in the offer.

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

(1) Company name.

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

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

(End of provision)

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 PRIORTIY RATING FOR NATIONAL DEFENSE USE (SEP 1990)

Any contract awarded as a result of this solicitation will be [] DX rated order; [X] 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)

52.214-31 FACSIMILE BIDS (DEC 1989)

(a) Definition. "Facsimile bid," as used in this solicitation, means a bid, modification of a bid, or withdrawal of a bid that is transmitted to and received by the Government via electronic equipment that communicates and reproduces both printed and hand-written material.

(b) Bidders may submit facsimile bids as responses to this solicitation. These responses must arrive at the place and by the time, specified in the solicitation.

(c) Facsimile bids that fail to furnish required representations or information or that reject any of the terms, conditions, and provisions of the solicitation may be excluded from consideration.

(d) Facsimile bids must contain the required signatures.

(e) The Government reserves the right to make award solely on the facsimile bid. However, if requested to do so by the Contracting Officer, the apparently successful bidder agrees to promptly submit the complete original signed bid.

(f) Facsimile receiving data and compatibility characteristics are as follows:

(1) Telephone number of receiving facsimile equipment: **(817) 886-6408**

(2) Compatibility characteristics of receiving facsimile equipment (e.g., make and model number, receiving speed, communications protocol): Digital Facsimile Transceiver; Make: Lanier; Model: 2230; Compatibility: CCITT Group 2 and 3, Communications: Half Duplex.

(g) If the bidder chooses to transmit a facsimile bid, the Government will not be responsible for any failure attributable to the transmission or receipt of the facsimile bid including, but not limited to, the following:

(1) Receipt of garbled or incomplete bid.

(2) Availability or condition of the receiving facsimile equipment.

(3) Incompatibility between the sending and receiving equipment.

(4) Delay in transmission or receipt of bid.

- (5) Failure of the bidder to properly identify the bid.
- (6) Illegibility of bid.
- (7) Security of bid data.

(End of clause)

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)

52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a firm fixed price contract resulting from this solicitation.

(End of clause)

52.217-5 EVALUATION OF OPTIONS (JUL 1990)

(a) Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

(b) The Government may reject an offer as nonresponsive if it is materially unbalanced as to prices for the basic requirement and the option quantities. An offer is unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated for other work.

(End of provision)

52.225-12 NOTICE OF BUY AMERICAN ACT REQUIREMENT-- CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (MAY 2002)

(a) Definitions. Construction material, designated country construction material, domestic construction material, foreign construction material, and NAFTA country construction material, as used in this provision, are defined in the clause of this solicitation entitled "Buy American Act --Construction Materials under Trade Agreements" (Federal Acquisition Regulation (FAR) clause 52.225-11).

(b) Requests for determination of inapplicability. An offeror requesting a determination regarding the inapplicability of the Buy American Act should submit the request to the Contracting Officer in time to allow a determination before submission of offers. The offeror shall include the information and applicable supporting data required by paragraphs (c) and (d) of FAR clause 52.225-11 in the request. If an offeror has not requested a determination regarding the inapplicability of the Buy American Act before submitting its offer, or has not received a response to a previous request, the offeror shall include the information and supporting data in the offer.

(c) Evaluation of offers. (1) The Government will evaluate an offer requesting exception to the requirements of the Buy American Act, based on claimed unreasonable cost of domestic construction materials, by adding to the offered price the appropriate percentage of the cost of such foreign construction material, as specified in paragraph (b)(4)(i) of FAR clause 52.225-11.

(2) If evaluation results in a tie between an offeror that requested the substitution of foreign construction material based on unreasonable cost and an offeror that did not request an exception, the Contracting Officer will award to the offeror that did not request an exception based on unreasonable cost.

(d) Alternate offers. (1) When an offer includes foreign construction material, other than designated country or NAFTA country construction material, that is not listed by the Government in this solicitation in paragraph (b)(3) of FAR clause 52.225-11, the offeror also may submit an alternate offer based on use of equivalent domestic, designated country, or NAFTA country construction material.

(2) If an alternate offer is submitted, the offeror shall submit a separate Standard Form 1442 for the alternate offer, and a separate price comparison table prepared in accordance with paragraphs (c) and (d) of FAR clause 52.225-11 for the offer that is based on the use of any foreign construction material for which the Government has not yet determined an exception applies.

(3) If the Government determines that a particular exception requested in accordance with paragraph (c) of FAR clause 52.225-11 does not apply, the Government will evaluate only those offers based on use of the equivalent domestic, designated country, or NAFTA country construction material, and the offeror shall be required to furnish such domestic, designated country, or NAFTA country construction material. An offer based on use of the foreign construction material for which an exception was requested--

- (i) Will be rejected as nonresponsive if this acquisition is conducted by sealed bidding; or
- (ii) May be accepted if revised during negotiations.

(End of provision)

52.232-38 SUBMISSION OF ELECTRONIC FUNDS TRANSFER INFORMATION WITH OFFER (MAY 1999)

The offeror shall provide, with its offer, the following information that is required to make payment by electronic funds transfer (EFT) under any contract that results from this solicitation. This submission satisfies the requirement to provide EFT information under paragraphs (b)(1) and (j) of the clause at 52.232-34, Payment by Electronic Funds Transfer--Other than Central Contractor Registration.

(1) The solicitation number (or other procurement identification number).

(2) The offeror's name and remittance address, as stated in the offer.

(3) The signature (manual or electronic, as appropriate), title, and telephone number of the offeror's official authorized to provide this information.

(4) The name, address, and 9-digit Routing Transit Number of the offeror's financial agent.

(5) The offeror's account number and the type of account (checking, savings, or lockbox).

(6) If applicable, the Fedwire Transfer System telegraphic abbreviation of the offeror's financial agent.

(7) If applicable, the offeror shall also provide the name, address, telegraphic abbreviation, and 9-digit Routing Transit Number of the correspondent financial institution receiving the wire transfer payment if the offeror's financial agent is not directly on-line to the Fedwire and, therefore, not the receiver of the wire transfer payment.

(End of provision)

52.233-2 SERVICE OF PROTEST (AUG 1996)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from Chief, Contracting Division, U.S. Army Engineer District, Fort Worth, 819 Taylor Street, Room 2A19, Fort Worth, Texas 76102-0300.

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

(End of provision)

52.236-27 SITE VISIT (CONSTRUCTION)(FEB 1995)

- (a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.
- (b) Site visits may be arranged during normal duty hours by contacting:
Leon Carroll, Area Engineer, [254-532-3047](tel:254-532-3047) (AM #1)
Central Texas Area Office

SECTION 01368

SPECIAL PROJECT PROCEDURES FOR FORT HOOD
AM #0001

PART 1 GENERAL

This Section covers the project requirements unique to Fort Hood, Texas. These unique requirements relate to items such as the digging permit process; use of Fort Hood airfields; tracer wire and marking tape specifications for the location of utility systems; Fort Hood landfill operations and permit requirements; local jacking, boring, and tunneling requirements; backflow prevention assembly documentation; and Customer Service Inspection certifications.

1.1 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:

SD-03 Product Data

Casing Pipe; G

10 days prior to jacking, boring, and tunneling activity, furnish catalog data for casing pipe.

AM #0001 Paint Usage and Material Safety Data Sheet (MSDS); G

Submit two copies of all paint systems for this contract and the associated MSDS. One copy for the Contracting Officer Representative (COR) and the other copy for the Air Quality Manager (telephone, 254-287-5284), DPW Environmental Division.

AM #0001 Data for HVAC Units; G

Submit two copies of all HVAC units and related data of each unit (i.e. name of manufacturer, model number, type of refrigerants and amount (in pounds). One copy for the Contracting Officer Representative (COR) and the other copy for the Ozone Depleting Chemical (ODC) Program Manager (phone no. 254-287-8714) DPW Environmental Division.

SD-04 Samples

Plastic Marking Tape and Tracer Wire; G

10 days prior to installation of utilities, furnish 305 mm long samples of marking tape for each applicable utility. Furnish 305 mm long sample of the tracer wire.

SD-07 Certificates

Customer Service Inspections; G.

The Contractor shall supply a "Customer Service Inspection" certificate for the water supply in accordance with the Texas Commission on Environmental Quality (TCEQ) regulations. The completed and signed certificate shall be submitted to the Contracting Officer for review and final approval. The ORIGINAL of the signed and dated form will be retained by Fort Hood DPW (authorized person).

A blank certificate is located at the end of this section. See paragraph CUSTOMER SERVICE INSPECTIONS for additional information.

Digging Permits; G.

Digging permits must be obtained prior to any digging, drilling or excavation. See paragraph DIGGING PERMITS for additional information.

Fort Hood Airfield Use; G.

Installation Airfield use is prohibited unless DA Forms 5205-R, 5206-R and 5207-R are completed, submitted and approved. See paragraph FORT HOOD AIRFIELDS for additional information.

Landfill Permit; G.

Contractor shall obtain permission from Fort Hood's Directorate of Public Works (DPW) to use the Post's landfill. Submit documentation granting permission and a completed landfill permit to the Contracting Officer prior to start of construction. A blank permit form is located at the end of this section. See paragraph CONDITIONS FOR USE OF FORT HOOD LANDFILL for additional information.

Backflow Prevention Assembly Tests; G.

Certification of proper operation of backflow preventers shall be accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation, including TCEQ's Appendix F form, at the time of the final inspection for the facility, that the tests have been performed and that the backflow preventers operate properly. The ORIGINAL of the signed and dated forms and documents will be retained by Fort Hood DPW (authorized person).

A copy of the TCEQ rule and sample of the form ("Appendix F Sample Backflow Prevention Assembly Test and Maintenance Report") can be obtained from the TCEQ's home page at the web site:

<http://163.234.20.106/index.html> or
http://info.sos.state.tx.us/fids/30_0290_0047-23.html.

Certification of Natural Gas Heating Equipment; G.

The Contractor shall comply with the Texas Commission on Environmental Quality (TCEQ) air emission requirement for water heaters, small boilers, and process heaters. Submit a document or

certificate to verify that the natural gas-fired heating equipment having a maximum rated rating capacity of 2.0 million British Thermal Units per hour (MMBtu/hr) or less is in compliance with the Nitrogen Oxide limits as specified in 30 Texas Administrative Code (TAC), Part 1, Chapter 117, Subchapter D, division 1, Rule 117.465.

1.2 FORT HOOD AIRFIELD USE

Contractors performing work under this contract may use airfields at Fort Hood with prior written notification and approval, providing:

a. All requests for Installation Airfield use shall be coordinated through the Office of the Commander, Installation Airfields, AFZF-DPC-AC, Hood Army Airfield, Fort Hood, TX 76544, telephone (254) 287-4266/5838.

b. Potential users shall submit completed DA Forms 5205-R (Certificate of Insurance), 5206-R (Civil Aircraft Landing Permit), and 5207-R (Hold Harmless Agreement). Forms are available through the Point of Contact (POC) mentioned in paragraph (a) above. User requests and specified forms shall be submitted at least 60 days before the first intended landing.

1.3 DIGGING PERMITS

The Contractor shall obtain digging permits directly from the Fort Hood Post DPW before any drilling, digging, or excavation is undertaken. Provide a completed form FHT 420-X10, Coordination for Land Excavation, to the DPW building 4612, Fort Hood, Texas for each permit. Allow 20 days for Government review of digging permit requests. A digging permit for a specified area of excavation expires 30 days after the issue date; Contractor must re-apply for a new permit to perform excavation in the area if the excavation was not started within the 30-day period. Permits will identify all underground utilities within 1500 mm of the designated area. Contractor shall be responsible for all repairs, costs, and damages due to excavating without permit or damaging an identified utility. Unidentified utilities shall be repaired by the Contractor at Government expense.

1.4 UTILITY INSTALLATION REQUIREMENTS

1.4.1 Plastic Marking Tape and Tracer Wire

Marking tape to be manufactured with integral wires or foil backing. Furnish and install the following marking tape and tracer wire:

a. Plastic Marking Tape

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 152 mm wide with minimum thickness of 0.102 mm (0.004 inch). Tape shall have a minimum strength of 12.1 MPa (1750 psi) lengthwise and 10.3 MPa (1500 psi) crosswise. The tape shall be of a type specifically manufactured for marking underground utilities. Tape shall be color as specified in Table 1 and bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

Red:	Electric
------	----------

Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Yellow:	Gas
Blue	Water
Green	Wastewater

b. Tracer Wire

For gas, water, force sanitary sewer mains, gas service lines, water service lines, and other pressurized utility systems, place No.10 AWG, THWN, CU, direct burial in trench bottom prior to sand bedding, and brought up in valve boxes and risers, with 305mm (12 inches) minimum leads above finished grade. Only direct-burial splices shall be used. Tracer is not required for underground electrical.

1.4.2 Jacking, Boring, and Tunneling

Conduct boring and jacking in a manner which does not interfere with the operation of the railroad or street or weakens or damages the embankment or structure. Bore or jack from the low or downstream end wherever possible. Unless otherwise shown or specified, the top of the casing pipe shall be a minimum of 914 mm below the finished road surface and 1220 mm below the bottom of the railroad track ballast.

a. Utilities

Excavate where possible and verify the location and depth of buried utilities which will be crossed.

b. Casing Pipe

Smooth wall steel pipe, ASTM A 53 with welded joints. Minimum wall thickness of 4.76 mm unless otherwise shown or specified.

c. Casing

Unless otherwise indicated or specified, install a casing pipe of a diameter which provides a minimum of 50 mm clearance between the outside diameter of the carrier pipe joint and the inside wall of the casing. Upon installation of the carrier pipe, sand grout the entire annular space between the casing and carrier pipe walls.

1.5 CONDITIONS FOR USE OF FORT HOOD LANDFILL

Use of the Fort Hood Municipal Solid Waste Landfill, located at the intersection of Turkey Run Road and Clark Road, by the Contractor is subject to the operating requirements imposed on the landfill by the Landfill Operating Permit. All waste delivered to the landfill will be inspected by the landfill operating Contractor for materials that are not authorized in the landfill. Trucks that contain unauthorized waste will be diverted for removal of the unauthorized material before being allowed to proceed to the working facility to dump their load. Landfill operating hours are 0730-1700 Monday through Friday and 0730-1400 on Saturday. Questions concerning landfill policy and procedures may be answered by calling the landfill at 532-2256.

The following classes of materials are not authorized in the Fort Hood Municipal Solid Waste Landfill and will be diverted as described below:

Recycle Materials: Cardboard and paperboard, light metal, aluminum and steel containers, paper, and plastic containers. Trucks entering the landfill with recyclable materials will be directed to a series of roll-off containers located at the entrance to the landfill for removal of the materials. Contractor/Transporters will be responsible for removing the unauthorized materials from the load and placing them in the properly marked container before proceeding to dump their load.

Compost Materials: Untreated wood, branches, shrubs, grass, wood chips, unserviceable or odd sized pallets shall be separated from the refuse load and delivered to the Fort Hood Compose Center located across Turkey Run Road from the landfill.

Clean Fill Material and Inert Constructions and Demolition Wastes: Soil, sand, sod, rock, clean masonry, brick, concrete, and pavement. These materials are not accepted at the landfill. Trucks containing these materials shall be disposed of as directed by the Contracting Officer (KO) or the KO's Authorized representative.

Salvageable Items: Tires, white goods and appliances, bulk scrap metal, lead-acid batteries, and engine and machine parts. Salvageable items should be delivered to DRMO Bldg. 4286, located at 80th St. and Tank Destroyer Blvd, phone 287-2723, Monday-Thursday, 0730-1300.

Serviceable Pallets: Serviceable pallets are to be delivered to Post Recycling Center Bldg. 4621, located at 65th St. and Railhead Dr., phone 287-6732, Monday-Friday, 0730-1600.)

Freon: Freon shall be collected in 50 pound retrievable containers and turned in to DPW supply, Bldg. 4406, 77th and Warehouse, phone 288-2383, Monday-Thursday, 0630-1700. An empty container will be furnished upon turn-in of the full container. Each container must be labeled (R-12, R-22, etc.) and shall not be mixed. If Freon is unintentionally mixed, the Contractor shall properly label the container as mixed and inform the DPW supply of the suspected mixture.

Regulated Waste: Regulated wastes such as liquid waste, fluorescent light bulbs, oil filters, ordinance, explosives, pressurized gases, PCB ballasts, paints, solvents, antifreeze, pesticides, herbicides, radioactive material, and bio hazardous material are not accepted at the landfill. Regulated waste shall be delivered to the DPW Waste Classification Unit, Bldg. 1345, located at 37th and North Ave., phone 288-SNAP, Monday-Friday, 0800-1600, unless otherwise specified in the Contract. **All turn-ins are by appointment only.** Call the DPW Classification Unit, 288-7627, to schedule an appointment. The DPW Classification Unit can help contractors with containers, packing procedures, waste classifications, and state notification.

Asbestos: Generator manifests must be obtained from the DPW Waste Classification Unit, Bldg. 1345, located at 37th and North Ave, phone 288-7627, Monday-Friday, 0800-1600. The transporter must have two originally signed manifests and then give the landfill 24 hours prior notice, phone 532-2256. Delivery of asbestos containing material (ACM), friable and non-friable, must be made prior to 1200 on the day of delivery. All ACM must be double bagged, in an enclosed trailer, off-loaded by hand and the driver must have two originally signed manifests. One large bundle is not acceptable due to the possibility of bag breakage upon off-loading and disposal activities. Non-friable ACM that has been damaged or has the potential of being damaged by off loading, grinding, cutting, sanding,

disposal or other invasive actions must also be double bagged.

Special Wastes: Properly characterized special wastes including fuel (TPH) contaminated soils (<1500 ppm), and demolition debris contaminated with lead paint (TCLP <5.0 mg/L) are allowed in the landfill. Documentation of all characterization tests must be provided to the Fort Hood DPW Waste Classification Unit and the landfill manager a minimum 48 hours prior to delivery of the material to the landfill. The Transporter must have a properly completed manifest at the time of delivery to the landfill. Copies of the Landfill's Waste Acceptance Plan, which contains specific requirements for disposal of the materials, may be obtained from DPW Environmental, phone 287-8713; DPW Services, phone 287-9606 or 288-7842; or the Landfill Operating Contractor, phone 532-2256.

The requirements of this clause are not intended to limit the Contractor's rights; the Contractor may dispose of recyclable, salvageable, regulated materials in any lawful manner the Contractor chooses outside of Fort Hood boundaries to the extent allowed by other contract provisions.

1.5.1 Landfill Permit

Contractor shall complete the attached Landfill Permit and give copies, laminated or inserted in page protectors, to drivers so that the drivers could leave them in their trucks. Drivers can just hand the permit to the scale operator at the landfill rather than having to remember all information.

1.6 CUSTOMER SERVICE INSPECTIONS

1.6.1 Certification Requirements

A Customer Service Inspection and Certification must be performed in accordance with the Texas Administrative Code, Title 30, Part 1, Chapter 290, Subchapter D, Rule 290.46 before providing continuous water service to new construction; on any existing service when the water purveyor has reason to believe that cross-connections or other potential contaminant hazards exist; or after any material improvement, correction, or addition to the private water distribution facilities.

1.6.2 Inspection

The Customer Inspection certifies that all performed work meets the requirements of the Texas Administrative Code, Title 30, Part 1, Chapter 290, Subchapter D, Rule 290.46.

1.6.3 Inspection Personnel

Customer Service Inspections must be performed by personnel meeting the requirements described in the Texas Administrative Code, Title 30, Part 1, Chapter 290, Subchapter D, Rule 290.46.

1.6.4 Inspection Certification Form

Original copies of the Customer Service Inspection Certification shall be provided to the Contracting Officer's Representative prior to final inspection and acceptance. Certification forms will be maintained by the Fort Hood DPW Water and Wastewater Utility representative. A sample form is provided at the end of this section. The form submitted shall meet all provisions of Rule 290.46. The form (appendix D) can also be down loaded from the TNRCC's home page at the web site:

http://info.sos.state.tx.us/fids/30_0290_0047-22.html.

1.7 Appendix F Sample Backflow Prevention Assembly Test & Maint. Report

The certificate "Appendix F. Sample Backflow Prevention Assembly Test and Maintenance Report" is attached at the end of this section.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 FORMS

3.1.1 Landfill Permit

LANDFILL PERMIT
US ARMY Corps of Engineers

COE POC and telephone phone number: _____

Contract Name: _____

Contract Number: _____

Contract completion date or end of authorization date: _____

Building or areas affected (i.e., Soldier's Development Center):

Prime Contractor's Name: _____

Contractor POC and phone (i.e. someone on site that can get immediate action): _____

Figure: 30 TAC §290.47(d)

Page 2 of 2

Service lines Lead [] Copper [] PVC [] Other []
Solder Lead [] Lead Free [] Solvent Weld [] Other []

I recognize that this document shall become a permanent record of the
aforementioned Public Water System and that I am legally responsible for
the validity of the information I have provided.

Remarks:

Signature of Inspector

Registration Number

Title

Type of Registration

Date

http://info.sos.state.tx.us/fids/30_0290_0047-22.html

-- End of Section --

SECTION 01770

CONTRACT CLOSEOUT
04/2001
Amendment No. 0001

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

(Am#1)

TRI-SERVICE CADD/GIS TECHNOLOGY CENTER (TSC)

TSC-01 A/E/C CADD Standard Manual (Current
Release as of Contract Award date)

U.S. ARMY CORPS OF ENGINEERS (COE)

COE-02 ARCHITECTURAL AND ENGINEERING INSTRUCTIONS
MANUAL (SWD-AEIM), Southwestern Division
(Current issue as of Contract Award date)

1.2 PAYMENT

Contract closeout activities such as, but not limited to, operation and maintenance manuals, record drawings, warranty requirements, equipment warranty identification tags, and inventories, payrolls, and shop drawing submittals, are subsidiary activities of the contract work; separate payment will not be made for any activity unless otherwise specified. Final contract payment will not be made until completion and approval of all contract closeout activities.

1.3 HVAC TESTING

The HVAC Testing that the Contractor schedules after substantial completion pursuant to paragraph entitled "Testing of Heating and Air-Conditioning Systems" of Section 01000 CONSTRUCTION SCHEDULE has a value to the Government of 10 percent of the value of the equipment to be tested. The Contractor shall reserve that amount to be paid on any equipment that will require testing after substantial completion pursuant to the above referenced specification paragraph.

1.4 OPERATION AND MAINTENANCE MANUALS

The Contractor shall be responsible for the preparation, coordination, execution and submittal of all operation and maintenance manuals (O & M Manuals), including spare parts lists, special tools, inventories of equipment manuals and maintenance instructions, and shall conduct all training for operating and service personnel. Operation and maintenance manuals shall cover all system installations provided in this contract and

shall be in sufficient detail to facilitate normal maintenance and troubleshooting by persons with minimum experience with the installed equipment.

1.4.1 Submittal Requirements

All of the above listed items required in the technical specifications shall be submitted to the Contracting Officer not less than 90 days prior to the scheduled contract completion date . Fully developed and approved operation and maintenance manuals shall be provided 30 days prior to scheduling training for operating and service personnel. The Contractor shall coordinate the content of each instruction period required in the technical specifications with the Contracting Officer's Representative prior to the actual start of the training period.

1.4.1.1 Video taping of Training for Operating and Service Personnel

Each instruction or training period as discussed above, shall be video taped in VHS FORMAT by the Contractor. The taping shall include the entire session(s). The original video tape(s) shall be labeled and turned over to the Contracting Officer. The video camera and tapes utilized by the Contractor, shall be of a quality to enable clear and understandable playbacks of the recorded events.

1.4.1.2 Draft O & M Manuals

On those systems where complete and comprehensive operation and maintenance manuals cannot be fully developed until the system(s) is checked, tested, and/or balanced, and the checking, testing, and/or balancing has not been done when submittals are required, a proposed draft of those system manual(s) shall be submitted. 10 percent of the each subsequent scheduled progress payment will be retained until the complete O & M Manuals submittal package have been submitted and approved. Submit fully developed O & M Manuals of the drafts for approval after the systems have been checked, tested, and/or balanced.

1.4.1.3 Commencement of Warranty of Construction

Failure to submit all specified O & M manuals, spare parts listings, spare parts, special tools, inventories of installed property, and training video tapes in a timely manner will be considered as delaying substantial completion of the work. Commencement of warranty under the Contract Clause WARRANTY OF CONSTRUCTION will not occur until all these items are delivered and approved by the Contracting Officer, but not earlier than the date of final acceptance of the work by the Government. When the O & M Manuals with drafts are approved they will not constitute a reason for delaying the start of the warranty period.

1.4.2 Government Possession of Work

The Government may take possession of any completed or partially completed work as provided for under Contract Clause entitled "USE AND POSSESSION PRIOR TO COMPLETION." If the installed equipment and/or systems thereto, have not been accepted by the Government due to the Contractor's failure to submit the above specified items, the Contractor shall operate and maintain such plant or system at no additional cost to the Government until such time that the specified items have been received, approved and any subsequent testing, check-out and/or training has been completed.

1.5 PREPARATION AND SUBMISSION OF OPERATION AND MAINTENANCE MANUALS

This paragraph establishes general requirements for the preparation and submission of equipment operating, maintenance, and repair manuals as called for in the various sections of the specifications. Specific instruction(s) relating to a particular system or piece of equipment shall be incorporated into the manuals in accordance with the applicable technical specification.

1.5.1 General Requirements

Furnish operations and maintenance manuals on CD-ROM disk along with a single hard copy. Documents on the CD-ROM disk shall be in portable document format (.pdf); all printed and graphic documents, drawings, and illustrations shall be legible. Hard copy requirements are specified below.

1.5.1.1 Hard Cover Binders

The manuals shall be permanently bound and have a hard cover. The following identification shall be inscribed on the cover: the words "EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUAL:" and the name, building number, location, and indication of utility or systems covered. Manuals shall be approximately 216 mm by 279 mm (8-1/2 by 11 inches) with large sheets folded in and capable of being easily pulled out for reference. All manuals for a single facility must be similar in appearance.

1.5.1.2 Warning Page

A warning page shall be provided to warn of potential dangers (if they exist), such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, or high pressures. The warning page shall be placed inside the front cover, in front of the title page.

1.5.1.3 Title Page

The title page shall show the name of the preparing firm (designer or contractor) and the date of publication.

1.5.1.4 Table of Contents

Provide in accordance with standard commercial practice.

1.5.2 Equipment Operating, Maintenance, and Repair Manuals

1.5.2.1 General

Separate manuals shall be provided for each utility system as defined hereinafter. Manuals shall be provided in the number of copies specified in the applicable technical section. Manuals shall include, in separate sections, the following information for each item of equipment:

a. Performance sheets and graphs showing capacity data, efficiencies, electrical characteristics, pressure drops, and flow rates. Marked-up catalogs or catalog pages do not satisfy this requirement. Performance information shall be presented as concisely as possible and contain only data pertaining to equipment actually installed.

b. Catalog cuts showing application information.

c. Installation information showing minimum acceptable requirements.

d. Operation and maintenance requirements. Include adequate illustrative material to identify and locate operating controls, indicating devices and locations of areas or items requiring maintenance.

(1) Describe, in detail, starting and stopping procedures for components, adjustments required to obtain optimum equipment performance, and corrective actions for malfunctions.

(2) Maintenance instructions describing the nature and frequency of routine maintenance and procedures to be followed. Indicate any special tools, materials, and test equipment that may be required.

e. Repair information including diagrams and schematics, guidance for diagnosing problems, and detailed instructions for making repairs. Provide troubleshooting information that includes a statement of the indication or symptom of trouble and the sequential instructions necessary. Include test hookups to determine the cause, special tools and test equipment, and methods for returning the equipment to operating conditions. Information may be in chart form or in tabular format with appropriate headings.

f. Parts lists and names and addresses of closest parts supply agencies.

g. Names and addresses of local manufacturers representatives.

1.5.2.2 Facility Heating Systems

Information shall be provided on the following equipment: Boilers, water treatment, chemical feed pumps and tanks, converters, heat exchangers, pumps, unit heaters, fin-tube radiation, air handling units (both heating only and heating and cooling), and valves (associated with heating systems).

1.5.2.3 Air-Conditioning Systems

Provide information on chillers, packaged air-conditioning equipment, towers, water treatment, chemical feed pumps and tanks, air-cooled condensers, pumps, compressors, air handling units, and valves (associated with air-conditioning systems).

1.5.2.4 Temperature Control and HVAC Distribution Systems

a. Provide the information described for the following equipment:

Valves, fans, air handling units, pumps, boilers, converters, and heat exchangers, chillers, water cooled condensers, cooling towers, and fin-tube radiation.

b. Provide all information described for the following equipment:

Control air compressors, control components (sensors, controllers, adapters, and actuators), and flow measuring equipment.

1.5.2.5 Central Heating Plants

Provide the information described for the following equipment: Boilers, converters, heat exchangers, pumps, fans, steam traps, pollution control equipment, chemical feed equipment, control systems, fuel handling

equipment, de-aerators, tanks (flash, expansion, return water, etc.), water softeners, and valves.

1.5.2.6 District Heating Distribution Systems

Provide the information described for the following equipment: Valves, fans, pumps, converters and heat exchangers, steam traps, tanks (expansion, flash, etc.) and piping systems.

1.5.2.7 Exterior Electrical Systems

Information shall be provided on the following equipment: Power transformers, relays, reclosers, breakers, and capacitor bank controls.

1.5.2.8 Interior Electrical Systems

Information shall be provided on the following equipment: Relays, motor control centers, switchgear, solid state circuit breakers, motor controller, and EPS lighting systems, control systems (wire diagrams and troubleshooting flow chart), and special grounding systems.

1.5.2.9 Energy Management and Control System

The maintenance manual shall include descriptions of maintenance for all equipment, including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components.

1.5.2.10 Domestic Water Systems

The identified information shall be provided on the following equipment: Tanks, unit process equipment, pumps, motors, control and monitoring instrumentation, laboratory test equipment, chemical feeders, valves, switching gear, and automatic controls.

1.5.2.11 Wastewater Treatment Systems

The identified information shall be provided on the following equipment: Tanks, unit process equipment, pumps, motors, control and monitoring instrumentation, laboratory test equipment, chemical feeders, valves, scrapers, skimmers, comminutors, blowers, switching gear, and automatic controls.

1.5.2.12 Fire Protection Systems

Information shall be provided on the following equipment: Alarm valves, manual valves, regulators, foam and gas storage tanks, piping materials, sprinkler heads, nozzles, pumps, and pump drivers.

1.5.2.13 Fire Detection Systems

The maintenance manual shall include description of maintenance for all equipment, including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.5.2.14 Plumbing Systems

Information shall be provided on the following equipment: Water heaters, valves, pressure regulators, backflow preventors, piping materials, and plumbing fixtures.

1.5.2.15 Liquid Fuels Systems

Information shall be provided on the following equipment: Tanks, automatic valves, manual valves, filter separators, pumps, mechanical loading arms, nozzles, meters, electronic controls, electrical switch gear, and fluidic controls.

1.5.2.16 Cathodic Protection Systems

Information shall be provided on the following material and equipment: Rectifiers, meters, anodes, anode backfill, anode lead wire, insulation material and wire size, automatic controls (if any), rheostats, switches, fuses and circuit breakers, type and size of rectifying elements, type of oil in oil-immersed rectifiers, and rating of shunts.

1.5.2.17 Generator Installations

Information shall be provided on the following equipment: Generator sets, automatic transfer panels, governors, exciters, regulators, starting systems, switchgear, and protective devices.

1.5.2.18 Miscellaneous Systems

Information shall be provided on the following: Communication and ADP systems, security and intrusion alarm, elevators, material handling, active solar, photovoltaic, and other similar type special systems not otherwise specified.

1.6 RECORD DRAWINGS

Record drawings shall be a record of the construction as installed and completed by the Contractor. They are a record of all deviations, modifications, or changes from contract set of drawings, however minor, which were incorporated in the work. They include all the information shown on the contract set of drawings, any Contractor-original drawings, all additional work not appearing on the contract drawings, and all changes which are made after final inspection of the contract work.

1.6.1 Contractor-Original Record Drawings

Contractor-original record drawings are those drawings drawn by the Contractor to further explain the Contract documents such as subcontractor submittals for fire protection/detection, communication, and other systems, and approved Contractor's solutions to problems. Submit these drawings as full-size reproducible sheets and CADD files. CADD files shall conform to the Working CADD file requirements specified in paragraph "Final Record Drawings."

1.6.2 Preliminary Record Drawings

The Contractor shall mark up both a reproducible set and a set of prints to show as-built conditions. These two sets, hereafter called preliminary record drawings, or singly, reproducible or prints, shall be kept current and available on the jobsite at all times, except as noted below. For drawings contained within the Specifications, the Contractor shall mark up copies of these drawings to show as-built conditions; these copies will be considered the preliminary record drawings and shall be kept current and available on the jobsite 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 record drawings. This assignment and any reassignment of duties concerning the maintenance of the record drawings shall be promptly reported to the Contracting Officer's representative for approval. All changes from the contract drawings which are made in 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 record drawings shall be clearly identified in a contrasting color and which is compatible with reproduction of the preliminary record drawings. Preliminary record drawings shall be updated by Friday of each week. During periods when the reproducibles are being copied and are therefore not available at the jobsite, the Contractor shall continue posting all required data to the prints. The Contractor shall minimize the time that the reproducibles are away from the jobsite and shall update them with all as-built data immediately upon their return. The preliminary record drawings will be jointly inspected for accuracy and completeness by the Contracting Officer's representative and the assigned representative of the Contractor's Quality Control Organization prior to submission of each monthly pay estimate. See paragraph, "Withholding for Preliminary Record Drawings." The record drawings shall show the following information, but not be limited thereto:

a. The location and description of utility lines or other installation of any kind or description known to or found to exist within the construction area. 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 150 mm 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., 900 mm to 1200 mm in depth). The description of exterior utilities includes the actual quantity, size, and material of utility lines.

b. The location and size of all uncharted existing utilities encountered.

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

d. Correct grade or alinement of roads, structures or utilities if any changes were made from contract drawings.

e. Correct elevations if changes were made in site grading.

f. 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.

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

h. Options

Where contract drawings or specifications allow options, only the option selected for construction shall be shown on the record drawings.

1.6.2.1 Blue Line or Black Line Prints

Blue line or black line prints shall be full size. All blue or black line 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.

1.6.2.2 Prefinal Inspection For Each Item of Work

As part of the prefinal inspection for each item of work, the preliminary record drawings will be reviewed. They shall comply with this specification prior to scheduling the final inspection, and/or prior to substantial completion of the item of work.

1.6.2.3 Preliminary Record Drawing Final Submittal

Prior to scheduling the final acceptance inspection of the last or only bid schedule item of work, the preliminary record drawings shall be completed and delivered to the Contracting Officer's Representative 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 record drawings on any or 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.

1.6.2.4 Withholding for Preliminary Record Drawings

Failure by the Contractor to maintain current and satisfactory preliminary record drawings in accordance with these requirements will result in withholding from progress payments 10 percent of the progress payment amount until such time as the record drawings are brought into compliance. This withheld amount will be indicated on monthly payment estimates until the Contractor has fulfilled these contract requirements.

1.6.2.5 Final Inspection

For each interim item of work, furnish a copy of the preliminary record drawings for that item, which the Contractor has reproduced from the approved preliminary record drawing reproducibles, to the Contracting Officer's representative at the time of final inspection for that item. At the time of final inspection on the last or only item of work, the Contractor shall deliver a copy of the complete set of the approved preliminary record drawings to the Contracting Officer's Representative.

1.6.3 Final Record Drawings

Upon approval of the preliminary record drawings, the Contracting Officer will return the approved preliminary record drawing prints back to the Contractor. The Contractor will then modify the CADD files as may be necessary to correctly show all the features of the project as it was constructed by bringing the contract set into agreement with the preliminary record drawings, including adding additional drawings and CADD files as may be necessary. The Contractor shall furnish the as-built drawings in the same file format as the Working CADD files. The CADD files are located on the Contract CD-ROM disk in Bentley Systems MicroStation, . These CADD files are part of the permanent records of this project and the

Contractor shall be responsible for the protection and safety thereof until final submittal to the Contracting Officer. Drawings, tracings, or CADD files damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at the Contractor's expense. CADD files will be audited by the Contracting Officer and for accuracy and conformance to the above specified drafting and CADD standards.

1.6.3.1 Drafting

Only personnel proficient in the preparation of engineering drawings and CADD shall be employed to modify the original contract drawings, prepare additional new drawings, and modify the CADD files. All modifications and new drawings shall conform to applicable requirements specified in the paragraph "CADD Standards." The Contractor shall ensure that all delivered CADD digital files and data (e.g., sheet files, model files, cell/block libraries) are compatible with the Government's target CADD system and operating system, and adhere to the standards and requirements specified. The term "compatible" means that data is in native digital format i.e., .dgn (MicroStation) or .dwg (AutoCAD). It is the responsibility of the Contractor to ensure this level of compatibility.

1.6.3.2 CADD Standards

CADD drawings shall be prepared in accordance with the applicable general and discipline-specific provisions for drawing formats, level/layer assignments, line colors, line weights, and line types of the TSC-01 (Tri-Service A/E/C Standards) .

The CADD standards, including seed/prototype files containing the Government's preset standard settings and electronic reference files containing the Government's standard border/title block sheets, are located at the following Web site:

<http://tsc.wes.army.mil/products/standards/aec/aecstdweb.asp>.

The Contractor shall submit a written request for approval of any deviations from the Government's established CADD standards. Deviations will not be permitted unless prior written approval of such deviations has been received from the Government.

1.6.3.3 Final Revisions

When final revisions have been completed, place the words "REVISED RECORD DRAWING," in letters at least 5 mm high, and the date of completion in the revision block above the latest existing revision notation on each drawing CADD file.

1.6.3.4 Border Sheets

The border sheet to be used for any new record drawings shall be the same as used on the original drawings.

1.6.3.5 Copies of the Final Record Drawings

Blue line or black line prints shall be full size. All blue or black line 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.

1.6.3.6 Delete Paragraph (Am#1)

1.6.3.7 Submittal Requirements

The Contractor shall submit to the Contracting Officer the final record drawings, consisting of one set of full size blue line or black line prints, one full size vellum reproducible set, and two sets of corrected CADD files on CD-ROM disks; verification that the CADD files have been loaded and work on the designated computer systems and are error- and virus-free; the approved preliminary blue lines; _____ (Am#1) and all required reproduced items. All paper prints, reproducible drawings, _____ (Am#1) and CADD files will become the property of the Government.

1.6.4 Post-Record Drawing Work

In event the Contractor accomplishes additional work which changes the as-built conditions of the facility after submission of the record drawings, the Contractor shall furnish revised and/or additional drawings (hard copy and CADD files), as required to depict as-built conditions. The requirements for these additional drawings, including CADD files, will be the same as for the record drawings included in the original submission.

1.6.5 Payment for Final Record Drawings

The amount listed for Final Record Drawings in the Bidding Schedule will be paid to the Contractor upon the Contracting Officer's acceptance of the completed record drawings.

1.7 ADDITIONAL WARRANTY REQUIREMENTS

The warranty requirements specified in this paragraph are in addition to those specified in the Contract Clause WARRANTY OF CONSTRUCTION in Section 00700 CONTRACT CLAUSES.

1.7.1 Performance Bond

It is understood that the Contractor's Performance Bond will remain effective throughout the life of all warranties and warranty extensions. This paragraph is applicable to the Contractor's Warranty of Construction only and does not apply to manufacturers' warranties on equipment, roofing, and other products.

(a) In the event the Contractor or the Contractor's designated representative fails to commence and diligently pursue any work required under the Warranty of Construction Paragraph within a reasonable time after receipt of written notification pursuant to the requirements thereof, the Contracting Officer shall have a right to demand that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Contracting Officer shall have the work performed by others, and after completion of the work, shall make demand for reimbursement of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

(b) Warranty repair work which arises to threaten the health or safety of personnel, the physical safety of property or equipment, or which impairs operations, habitability of living spaces, etc., will be handled by

the Contractor on an immediate basis as directed verbally by the Contracting Officer or the Contracting Officer's authorized representative. Written verification will follow verbal instructions. Failure of the Contractor to respond as verbally directed will be cause for the Contracting Officer or the Contracting Officer's authorized representative to have the warranty repair work performed by others and to proceed against the Contractor as outlined in the paragraph (a) above.

1.7.2 Pre-Warranty Conference

Prior to contract completion and at a time designated by the Contracting Officer or Contracting Officer's authorized representative, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of Contract Clause WARRANTY OF CONSTRUCTION. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer or Contracting Officer's authorized representative for the execution of the construction warranty shall be established/reviewed at this meeting.

In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This single point of contact will be located within the local service area of the warrantied construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of Contractor's responsibilities in connection with Contract Clause WARRANTY OF CONSTRUCTION.

1.7.3 Equipment Warranty Identification Tags

The Contractor shall provide warranty identification tags on all equipment installed under this contract. Tags and installation shall be in accordance with the requirements of Paragraph: EQUIPMENT WARRANTY IDENTIFICATION TAGS.

1.7.4 Contractor's Response to Construction Warranty Service Requirements

The following warranty service requirements are applicable to contracts for Fort Hood and will supersede requirements listed in Paragraph: Warranty of Construction. Following notification by the Contracting Officer or the Contracting Officer's Representative the Contractor shall respond to a warranty service requirement identified by the Contracting Officer's Representative in accordance with the "Warranty Service Priority List" of this program. This list prioritizes warranty work into the categories. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframes specified, the Government will perform the work and backcharge the construction warranty payment item established.

The Contractor shall establish an activity in the Contractor's schedule with this amount. The duration for this activity will be 365 days. Payment for this activity will be as follows: 25 percent after six months of the warranty period has passed; the remaining 75 percent will be paid at

the end of the warranty period, if there are no outstanding warranty items.:

First Priority 1A Perform on site inspection to evaluate situation, determine course of action, initiate work within 24 hours and work continuously to completion or relief.

Second Priority 1B Perform on site inspection to evaluate situation, determine course of action, initiate work within 48 hours and work continuously to completion or relief.

Third Priority All other work to be initiated within 5 work days and work continuously to completion or relief.

The "Warranty Service Priority List" is as follows:

- 1A Air Traffic Control and Air Navigation Systems and Equipment.
- 1A Air Conditioning System
 - a. Hospital.
 - b. Buildings with computer equipment.
 - c. Commissary and Main PX.
 - d. Clubs.
 - e. Barracks, mess halls, BOQ/BEQ (entire building down).
 - f. Troop medical and dental.
- 1B Air Conditioning Systems
 - a. Recreational support.
 - b. Air conditioning leak in part of building, if causing damage.
 - c. Admin buildings with ADP equipment not on priority list.
- 1A Doors
 - a. Overhead doors not operational.
- 1A Electrical
 - a. Power failure (entire area or any building operational after 1600 hours).
 - b. Traffic control devices.
 - c. Security lights.
- 1B Electrical
 - a. Power failure (no power to a room or part of building).
 - b. Receptacle and lights.
 - c. Fire alarm systems.
- 1A Gas
 - a. Leaks and breaks.
 - b. No gas to family housing unit or cantonment area.
- 1A Heat
 - a. Hospital/Medical facilities.
 - b. Commissary and Main PX.
 - c. Clubs.
 - d. Area power failure affecting heat.
- 1B Heat
 - a. Medical storage.
 - b. Barracks.

- 1A Intrusion Detection Systems
Finance, PX and Commissary, and high security areas.
- 1B Intrusion Detection Systems
Systems other than priority 1A.
- 1A Kitchen Equipment
 - a. Dishwasher.
 - b. All other equipment hampering preparation of a meal.
- 1B Kitchen Equipment
All other equipment not in priority 1A.
- 1B Plumbing
 - a. Flush valves.
 - b. Fixture drain, supply line commode, or water pipe leaking.
 - c. Commode leaking at base.
- 1A Refrigeration
 - a. Commissary.
 - b. Mess hall.
 - c. Cold storage.
 - d. Hospital.
 - e. Medical storage.
- 1B Refrigeration
Mess hall - other than walk-in refrigerators and freezers.
- 1A Roof Leaks
Temporary repairs will be made where major damage to property is occurring.
- 1B Roof Leaks
Check for location of leak during rain to be repaired on priority 2 (major damage to property is not occurring).
- 1A Swimming Pools
Chlorine leaks or broken pumps.
- 1A Tank Wash Racks (Bird Baths)
All systems which prevent tank wash.
- 1A Water (Exterior)
Normal operation of water pump station.
- 1B Water (Exterior)
No water to facility.
- 1A Water, Hot (and Steam)
 - a. Hospitals.
 - b. Mess halls.
 - c. BOQ, BEQ, barracks (entire building).
 - d. Medical and dental.
- 1B Water, Hot
No hot water in portion of building listed in priority 1A (items a through c).
- 1A Sprinkler System

All sprinkler systems, valves, manholes, deluge systems, and air systems to sprinklers.

Should parts be required to complete the work and the parts are not immediately available the Contractor shall have a maximum of 12 hours after arrival at the job site to provide the Contracting Officer's Representative with firm written proposals for emergency alternatives and temporary repairs for Government participation with the Contractor to provide emergency relief until the required parts are available on site for the Contractor to perform permanent warranty repair. The Contractor's proposals shall include a firm date and time that the required parts shall be available on site to complete the permanent warranty repair. The Contracting Officer's Representative will evaluate the proposed alternatives and negotiate the alternative considered to be in the best interest of the Government to reduce the impact of the emergency condition. Alternatives considered by the Contracting Officer's Representative will include the alternative for the Contractor to "Do Nothing" while waiting until the required parts are available to perform permanent warranty repair. Negotiating a proposal which will require Government participation and the expenditure of Government funds shall constitute a separate procurement action by the using service.

1.8 EQUIPMENT WARRANTY IDENTIFICATION TAGS

1.8.1 General Requirements

The Contractor shall provide warranty identification tags on all Contractor and Government furnished equipment which he has installed.

1.8.1.1 Tag Description and Installation

The tags shall be similar in format and size to the exhibits provided by this specification, they shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and they shall be installed in a position that is easily (or most easily) noticeable. Contractor furnished equipment that has differing warranties on its components will have each component tagged.

1.8.1.2 Sample Tags

Sample tags shall be submitted to the Contracting Officer's Authorized Representative for review and approval. These tags shall be filled out representative of how the Contractor will complete all other tags.

1.8.1.3 Tags for Warranted Equipment

The tag for this equipment shall be similar to the following. Exact format and size will be as approved by the Contracting Officer's Authorized Representative. The Contractor warranty expires (warranty expiration date) and the final manufacturer's warranty expiration dates will be determined as specified by the Paragraph "WARRANTY OF CONSTRUCTION."

EQUIPMENT WARRANTY CONTRACTOR FURNISHED EQUIPMENT	
MFG _____	MODEL NO. _____
SERIAL NO. _____	
CONTRACT NO. _____	
CONTRACTOR NAME _____	
CONTRACTOR WARRANTY EXPIRES _____	
MFG WARRANTY(IES) EXPIRE _____	

1.8.1.4 Duplicate Information

If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag.

1.8.2 Execution

The Contractor will complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment. The Contractor will schedule this activity in the Contractor progress reporting system. The final acceptance inspection is scheduled based upon notice from the Contractor, thus if the Contractor is at fault in this inspection being delayed, the Contractor will, at the Contractor's own expense, update the in-service and warranty expiration dates on these tags.

1.8.3 Payment

The work outlined above is a subsidiary portion of the contract work, and has a value to the Government approximating 5% of the value of the Contractor furnished equipment. The Contractor will assign up to that amount, as approved by the Contracting Officer's Authorized Representative.

1.8.4 Equipment Warranty Tag Replacement

Under the terms of this contract, the Contractor's warranty with respect to work repaired or replaced shall run for one year from the date of repair or replacement. Such activity shall include an updated warranty identification tag on the repaired or replaced equipment. The tag shall be furnished and installed by the Contractor, and shall be identical to the original tag, except that the Contractor's warranty expiration date will be one year from the date of acceptance of the repair or replacement.

1.9 INVENTORY OF CONTRACTOR FURNISHED AND INSTALLED EQUIPMENT

A list of equipment or units of equipment that require electrical power or fuel, or may require removal or replacement such as AHUs, fans, air conditioners, compressors, condensers, boiler, thermal exchangers, pumps,

cooling towers, tanks, fire hydrants, sinks, water closets, lavatories, urinals, shower stalls, and any other large plumbing fixtures, light fixtures, etc., shall be made and kept up to date as installed. The list shall be reviewed periodically by the Government to insure completeness and accuracy. Partial payment will be withheld for equipment not incorporated in the list. List shall include on each item as applicable: Description, Manufacturer, Model or Catalog No., Serial No., Input (power, voltage, BTU, etc.), Output (power, voltage, BTU, tons, etc.), Size or Capacity (tanks), and net inventory costs; any other data necessary to describe item and shall list all warrantors and warranty periods for each item of equipment. Final list shall be turned over to the Authorized Representative of the Contracting Officer at the time of the Contractor's quality control completion inspection.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

SECTION 04200A

MASONRY

10/01 Amendment No. 0001

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI SP-66 (1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82 (1997a) Steel Wire, Plain, for Concrete Reinforcement

ASTM A 153/A 153M (2000) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 615/A 615M (2000) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C 55 (1999) Concrete Brick

ASTM C 62 (2000) Building Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C 67 (2000) Sampling and Testing Brick and Structural Clay Tile

ASTM C 90 (2000) Loadbearing Concrete Masonry Units

ASTM C 91 (1999) Masonry Cement

ASTM C 126 (1999) Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units

ASTM C 129 (2000) Nonloadbearing Concrete Masonry Units

ASTM C 140 (1999b) Sampling and Testing Concrete Masonry Units

ASTM C 216 (2000) Facing Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C 270 (2000) Mortar for Unit Masonry

ASTM C 476 (1999) Grout for Masonry

ASTM C 494/C 494M	(1999a) Chemical Admixtures for Concrete
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 641	(1982; R 1998e1) Staining Materials in Lightweight Concrete Aggregates
ASTM C 780	(2000) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 1019	(2000) Sampling and Testing Grout
ASTM C 1072	(2000) Measurement of Masonry Flexural Bond Strength
ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM D 2240	(2000) Rubber Property - Durometer Hardness
ASTM D 2287	(1996a) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E 119	(2000) Fire Tests of Building Construction and Materials
ASTM E 447	(1997) Compressive Strength of Masonry Prisms
ASTM E 514-74	(1974) Integral Liquid Polymeric Admixture

1.2 RELATED SECTIONS

See the following section for additional requirements:

04225 HIGH PERFORMANCE CONCRETE MASONRY

1.3 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:

SD-02 Shop Drawings

Masonry Work; G,

Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; and wall openings. Bar splice locations shall be shown. Drawings shall be provided showing the location and layout of glass block units. If the Contractor opts to furnish inch-pound CMU products, drawings showing elevation of walls exposed to view and indicating the location of all cut CMU products shall be submitted for approval. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1 to 50. Reinforcement bending details shall conform to the requirements of ACI SP-66.

SD-03 Product Data

Clay or Shale Brick; G,
Concrete Brick; G,

Manufacturer's descriptive data.

Cold Weather Installation; G,

Cold weather construction procedures.

SD-04 Samples

Concrete Masonry Units (CMU); G,

Clay or Shale Brick; G,

Color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture.

Anchors, Ties, and Bar Positioners; G,

Two of each type used.

Expansion-Joint Material; G,

One piece of each type used.

Joint Reinforcement; G,

One piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

Insulation; G,

One piece of board type insulation, not less than 400 by 600 mm in size, containing the label indicating the rated permeance and R-values.

Portable Panel; G,

One panel of clay or shale brick, 600 by 600 mm, containing approximately 24 brick facings to establish range of color and texture.

SD-06 Test Reports

Efflorescence Test; G,
Field Testing of Mortar; G,
Field Testing of Grout; G,

Masonry Cement; G,
Fire-rated CMU; G,

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

Special Inspection; G,

Copies of masonry inspector reports.

SD-07 Certificates

Clay or Shale Brick;
Concrete Brick;
Concrete Masonry Units (CMU);

Control Joint Keys;
Anchors, Ties, and Bar Positioners;
Expansion-Joint Materials;
Joint Reinforcement;
Reinforcing Steel Bars and Rods;
Masonry Cement;
Mortar Coloring;
Insulation;
Precast Concrete Items;
Mortar Admixtures;
Grout Admixtures;

Certificates of compliance stating that the materials meet the specified requirements.

Insulation;

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

1.4 SAMPLE MASONRY PANELS

After material samples are approved and prior to starting masonry work, sample masonry panels shall be constructed for each type and color of masonry required. At least 48 hours prior to constructing the sample panel or panels, the Contractor shall submit written notification to the Contracting Officer's Representative. Sample panels shall not be built in, or as part of the structure, but shall be located where directed.

1.4.1 Configuration

Panels shall be L-shaped or otherwise configured to represent all of the wall elements. Panels shall be of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. The minimum size of a straight panel or a leg of an L-shaped panel shall be 2.4m LONG BY 2.4m HIGH BY 1.6m WIDE

1.4.2 Composition

Panels shall show full color range, texture, and bond pattern of the masonry work. Panels shall also be furnished with (water repellant) sealer as specified herein. The Contractor's method for mortar joint tooling; grouting of reinforced vertical cores, collar joints, bond beams, and lintels; positioning, securing, and lapping of reinforcing steel; positioning and lapping of joint reinforcement (including prefabricated corners); and cleaning of masonry work and application of sealer shall be demonstrated during the construction of the panels. Installation or application procedures for anchors, wall ties CMU control joints, brick expansion joints, insulation, flashing, brick soldier, row lock courses and weep holes shall be shown in the sample panels. The panels shall contain a masonry bonded corner that includes a bond beam corner. Panels shall show parging and installation of electrical boxes and conduit. Panels that represent reinforced masonry shall contain a 600 by 600 mm opening placed at least 600 mm above the panel base and 600 mm away from all free edges, corners, and control joints. Required reinforcing shall be provided around this opening as well as at wall corners and control joints.

1.4.3 Construction Method

Where anchored veneer walls are required, the Contractor shall demonstrate and receive approval for the method of construction; i.e., either bring up the two wythes together or separately, with the insulation and appropriate ties placed within the specified tolerances across the cavity. Temporary provisions shall be demonstrated to preclude mortar or grout droppings in the cavity and to provide a clear open air space of the dimensions shown on the drawings. Where masonry is to be grouted, the Contractor shall demonstrate and receive approval on the method that will be used to bring up the masonry wythes; support the reinforcing bars; and grout cells, bond beams, lintels, and collar joints using the requirements specified herein. If sealer is specified to be applied to the masonry units, sealer shall be applied to the sample panels. Panels shall be built on a properly designed concrete foundation.

1.4.4 Usage

The completed panels shall be used as the standard of workmanship for the type of masonry represented. Masonry work shall not commence until the sample panel for that type of masonry construction has been completed and approved. Panels shall be protected from the weather and construction operations until the masonry work has been completed and approved. After completion of the work, the sample panels, including all foundation concrete, shall become the property of the Contractor and shall be removed from the construction site.

1.5 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

1.5.1 High Performance Masonry Units

High Performance Concrete masonry units shall be covered or protected from inclement weather. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.5.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.5.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

1.6 SPECIAL INSPECTION

A qualified masonry inspector approved by the Contracting Officer shall perform inspection of the masonry work. Minimum qualifications for the masonry inspector shall be 5 years of reinforced masonry inspection experience or acceptance by a State, municipality, or other governmental body having a program of examining and certifying inspectors for reinforced masonry construction. The masonry inspector shall be present during preparation of masonry prisms, sampling and placing of masonry units, placement of reinforcement (including placement of dowels in footings and foundation walls), inspection of grout space, immediately prior to closing of cleanouts, and during grouting operations. The masonry inspector shall assure Contractor compliance with the drawings and specifications. The masonry inspector shall keep a complete record of all inspections and shall submit daily written reports to the Quality Control Supervisory Representative reporting the quality of masonry construction.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished

work shall not be changed after the work has started except with Contracting Officer's approval.

2.2 CLAY OR SHALE BRICK

Color range and texture of clay or shale brick shall be as indicated in Section 09915 - COLOR SCHEDULE and shall conform to the approved sample. Grade SW shall be used for brick in contact with earth or grade and for all exterior work. Brick shall be tested for efflorescence. Clay or shale brick units shall be delivered factory-blended to provide a uniform appearance and color range in the completed wall.

2.2.1 Solid Clay or Shale Brick

Solid clay or shale brick shall conform to ASTM C 216, Type FBS. Brick size shall be modular and the nominal size of the brick used shall be 57 mm thick, 90 mm wide, and 190 mm long. Minimum compressive strength of the brick shall be 17.2 MPa .

2.3 CONCRETE MASONRY UNITS (CMU)

All concrete masonry units (cmu) shall be High Performance Concrete Masonry Units (HPCMU) as specified in Section 04225 - HIGH PERFORMANCE CONCRETE MASONRY.2.3.1 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 25 mm . Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

2.3.1.1 Architectural Units

Units shall have patterned face shell. Face shell pattern shall be split face. Window sill units on the first floor of the Soldier Community Building and the Company Operations Buildings shall be smooth face units. Smooth face units shall also be provided as substraits where ceramic tile is shown on exterior veneer. Units shall be integrally colored and provided with an integral liquid polymeric (water repellent) admixture ("Dry Block" by the W.R. Grace Co.) in accordance with ASTM E 514-74 during manufacture. Color shall be as indicated in Section 09915 - COLOR SCHEDULE. Patterned face shell shall be properly aligned in the completed wall.

2.3.2 Fire-Rated CMU

Fire-rated CMU shall be Fire-Rated HPCMU as specified in Section 04225 - HIGH PERFORMANCE CONCRETE MASONRY

2.4 PRECAST CONCRETE ITEMS

Trim, lintels, copings, splashblocks and door sills shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 28 MPa (4000 psi) minimum conforming to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE using 13 mm (1/2 inch) to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Clearance of 20 mm shall be maintained between reinforcement and

faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 827 kPa (120 psi) for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days or longer. Cast-concrete members weighing over 35 kg shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises and shall be cast with drip grooves on the underside where units overhang walls. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color equal to adjacent concrete item color/finish. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

2.4.1 Lintels

Precast or cast-in-place lintels, unless otherwise shown, shall be of a thickness equal to the wall and reinforced with two No. 4 bars for the full length. Top of lintels shall be labeled "TOP" or otherwise identified and each lintel shall be clearly marked to show location in the structure.

2.4.2 Sills and Copings

Sills and copings shall be cast with washes. Sills for windows having mullions shall be cast in sections with head joints at mullions and a 6 mm (1/4 inch) allowance for mortar joints. The ends of sills, except a 20 mm wide margin at exposed surfaces, shall be roughened for bond. Treads of door sills shall have rounded nosings.

2.4.3 Splash Blocks

Splash blocks shall be as detailed. Reinforcement shall be the manufacturer's standard.

2.5 STONE ITEMS

For stone items refer to Section 04735 - CAST STONE.

2.6 MORTAR

Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C 780 and ASTM C 1072. Mortar for prefaced concrete masonry units shall contain aggregates with 100 percent passing the 2.36 mm sieve and 95 percent passing the 1.18 mm sieve. Pointing mortar in kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.6.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall

contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C. All exposed exterior masonry (brick, split-face CMU units, and smooth-face CMU units) shall be laid using mortar with an integral liquid polymeric (water repellent) admixture in accordance with ASTM E 514-74.

2.6.2 Coloring

Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color as indicated in Section 09915: Color Schedule. Two colors of mortar shall be provided. Mortar color for split-face and smooth-face units shall be equal to split-face in color. Mortar color for brick shall be equal to brick in color. Mortar coloring shall not exceed 3 percent of the weight of cement for carbon black and ten percent of the weight of cement for all other pigments. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement.

2.7 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 200 and 250 mm. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

2.7.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

2.7.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.8 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153/A 153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82. Anchors and ties shall be sized to provide a minimum of 16 mm mortar cover from either face.

2.8.1 Wire Mesh Ties

Wire mesh for tying 100 mm thick concrete masonry unit partitions to other intersecting masonry partitions shall be 13 mm mesh of minimum 16 gauge steel wire. Minimum lengths shall be not less than 300 mm .

2.8.2 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 5 mm diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 100 mm wide. Wall ties may also be of a continuous type conforming

to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 5 mm diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 13 mm eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 2 mm . The pintle and eye elements shall be formed so that both can be in the same plane.

2.8.3 Dovetail Anchors

Dovetail anchors shall be of the flexible wire type, 5 mm diameter zinc-coated steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section. These anchors shall be used for anchorage of veneer wythes or composite-wall facings extending over the face of concrete columns, beams, or walls. Cells within vertical planes of these anchors shall be filled solid with grout for full height of walls or partitions, or solid units may be used. Dovetail slots are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

2.8.4 Adjustable Anchors

Adjustable anchors shall be 5 mm diameter steel wire, triangular-shaped. Anchors attached to steel shall be 8 mm diameter steel bars placed to provide 2 mm play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

2.8.5 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

2.9 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153/A 153M, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 16 mm cover from either face. The distance between crosswires shall not exceed 400 mm . Joint reinforcement for straight runs shall be furnished in flat sections not less than 3 m long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

2.10 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615/A 615M, Grade 60.

2.11 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural

or synthetic rubber (or combination thereof) conforming to ASTM D 2000 or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 16 mm thick and 10 mm thick flanges, with a tolerance of plus or minus 2 mm (1/16 inch). The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 34 degrees C after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

2.12 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07900 JOINT SEALING.

2.13 INSULATION

2.13.1 Rigid Board-Type Insulation

Rigid board-type insulation shall be extruded polystyrene, polyurethane, or polyisocyanurate. Polystyrene shall conform to ASTM C 578. Polyisocyanurate shall conform to ASTM C 1289, Type I or Type II. The insulation shall be a standard product and shall be marked with not less than the manufacturer's trademark or name, the specification number, the permeance and R-values.

2.13.1.1 Insulation Thickness and Air Space

The cavity space shall allow for a maximum board-type insulation thickness of 40 mm (1 1/2"), and a minimum air space of 20 mm.

2.13.1.2 Aged R-Value

The insulation shall provide a minimum aged R-value of 1.32 SI Units (7.5 IP Units) for the overall thickness. The aged R-value shall be determined at 24 degrees C in accordance with the appropriate referenced specification. The stated R-value of the insulation shall be certified by an independent testing laboratory or certified by an independent Registered Professional Engineer if tests are conducted in the manufacturer's laboratory.

2.13.1.3 Recovered Material

Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERD MATERIALS. The polyurethane or polyisocyanurate foam shall have a minimum recovered material content of 9 percent by weight of the core material.

2.13.2 Insulation Adhesive

Insulation adhesive shall be specifically prepared to adhere the insulation to the masonry dampproofing and, where applicable, to the thru-wall flashing. The adhesive shall not deleteriously affect the insulation or dampproofing, and shall have a record of satisfactory and proven performance for the conditions under which to be used.

2.14 FLASHING

Flashing shall be as specified in Section 07600 SHEET METALWORK, GENERAL. Provide horizontal flashing full width of veneer (100 mm) at top of split-face veneer units, where split-face veneer and brick veneer abutt.
(Am#1)

2.15 WEEP HOLE VENTILATORS

Weephole ventilators shall be prefabricated aluminum grill type vents designed to prevent insect entry with maximum air entry. Ventilators shall be sized to match modular construction with a standard 10 mm mortar joint.

2.15.1 MORTAR DROPPING COLLECTION DEVICE

Mortar dropping collection device shall be manufactured of high density polyethylene, nylon or recycled polyester designed to catch mortar droppings above the level of the weep holes. The collection device will allow water and air to move through the device to the weep holes.

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 37 degrees C in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 1.2 m ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 4 degrees C, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

- a. Air Temperature 4 to 0 degrees C . Sand or mixing water shall be heated to produce mortar temperatures between 4 and 49 degrees C .
- b. Air Temperature 0 to minus 4 degrees C . Sand and mixing water shall be heated to produce mortar temperatures between 4 and 49 degrees C . Temperature of mortar on boards shall be maintained above freezing.
- c. Air Temperature minus 4 to minus 7 degrees C . Sand and mixing

water shall be heated to provide mortar temperatures between 4 and 49 degrees C . Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 24 km/hour .

- d. Air Temperature minus 7 degrees C and below. Sand and mixing water shall be heated to provide mortar temperatures between 4 and 49 degrees C . Enclosure and auxiliary heat shall be provided to maintain air temperature above 0 degrees C . Temperature of units when laid shall not be less than minus 7 degrees C .

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

- a. Mean daily air temperature 4 to 0 degrees C . Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.
- b. Mean daily air temperature 0 to minus 4 degrees C . Masonry shall be completely covered with weather-resistant membrane for 24 hours.
- c. Mean Daily Air Temperature minus 4 to minus 7 degrees C . Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.
- d. Mean Daily Temperature minus 7 degrees C and Below. Masonry temperature shall be maintained above 0 degrees C for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond pattern unless otherwise indicated. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 13 mm . Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 13 mm into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. In double wythe construction, the inner wythe may be brought up not more than 400 mm ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 200 mm .

3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 3 mm . Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Clay or Shale Brick Units

Brick facing shall be laid with the better face exposed. Brick shall be laid in running bond with each course bonded at corners, unless otherwise indicated. Molded brick shall be laid with the frog side down. Brick that is cored, recessed, or has other deformations may be used in sills, treads, soldier courses, except where deformations will be exposed to view.

3.2.4.1 Wetting of Units

Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 0.155 gm per minute per square cm (1 gm per minute per square inch) of bed surface shall be in conformance with ASTM C 67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid.

3.2.4.2 Solid Units

Bed, head, and collar joints shall be completely filled with mortar.

3.2.4.3 Hollow Units

Hollow units shall be laid as specified for concrete masonry units.

3.2.5 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond

pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

3.2.5.1 Surface to Recieve Ceramic Tile

Masonry surfaces shall be level and plumb with struck joints and square openings. No variations in the surfaces exceeding 3mm in 30 meters and no abrupt irregularities exceeding 1.6 mm shall be allowed where ceramic tile is installed over masonry areas.

3.2.5.2 Surfaces to Recieve Vinyl Wallcovering

Masonry surfaces shall be level and plumb with struck joints and square openings. No variations in the surfaces exceeding 3mm in 30 meters and no abrupt irregularities shall be allowed where vinyl coated wallcovering is installed over masonry areas.

TABLE II

TOLERANCES

Variation from the plumb in the lines
and surfaces of columns, walls and arises

In adjacent masonry units	3 mm
In 3 m	6 mm
In 6 m	10 mm
In 12 m or more	13 mm

Variations from the plumb for external corners,
expansion joints, and other conspicuous lines

In 6 m	6 mm
In 12 m or more	13 mm

Variations from the level for exposed lintels,
sills, parapets, horizontal grooves, and other
conspicuous lines

In 6 m	6 mm
In 12 m or more	13 mm

Variation from level for bed joints and top
surfaces of bearing walls

In 3 m	6 mm
In 12 m or more	13 mm

Variations from horizontal lines

TOLERANCES

In 3 m	6 mm
In 6 m	10 mm
In 12 m or more	13 mm

Variations in cross sectional dimensions of
columns and in thickness of walls

Minus	6 mm
Plus	13 mm

3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 300 mm wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.7 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.7.1 Flush Joints

Joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas shall be flush cut. Flush cut joints shall be made by cutting off the mortar flush with the face of the wall. Joints in unparged masonry walls below grade shall be pointed tight. Flush joints for architectural units, such as fluted units, shall completely fill both the head and bed joints.

3.2.7.2 Tooled Joints

Joints in exposed exterior and interior brick masonry surfaces shall be tooled slightly concave. Joints in exposed exterior split-face cmu masonry surfaces shall be tooled flush. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm . On the exterior side of exterior frames, joints between frames and abutting

masonry walls shall be raked to a depth of 10 mm .

3.2.8 Joint Widths

Joint widths shall be as follows:

3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have 10 mm joints.

3.2.8.2 Brick

Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length. Brick expansion joint widths shall be as shown.

3.2.9 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

3.2.10 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Tothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

3.2.11 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

3.2.12 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 100 mm above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Interior partitions having 100 mm nominal thick units shall be tied to intersecting partitions of 100 mm units, 125 mm into partitions of 150 mm units, and 175 into partitions of 200 mm or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units may be used. Interior partitions having masonry walls over 100 mm thick shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

3.3 ANCHORED VENEER CONSTRUCTION

The inner and outer wythes shall be completely separated by a continuous airspace as shown on the drawings. Both the inner and the outer wythes shall be laid up together except when adjustable joint reinforcement assemblies are approved for use or when dampproofing on board-type insulation is installed against the inner wythe. When both wythes are not brought up together, through-wall flashings shall be protected from damage until they are fully enclosed in the wall. The airspace between the wythes shall be kept clear and free of mortar droppings. A coarse gravel or drainage material shall be placed behind the weep holes in the cavity to a minimum depth of 100 mm of coarse aggregate or 250 mm of drainage material to keep mortar droppings from plugging the weep holes.

3.3.1 Dampproofing and Board-Type Insulation

Masonry units to receive dampproofing and board-type insulation shall be free from chipped edges, protrusions, cracks, and other imperfections which could interfere with installed systems. Joint reinforcement, anchors, and ties shall be kept clean of dampproofing, moisture, and other foreign matter when the outer wythe is laid. Dampproofing is specified in Section 07110 BITUMINOUS DAMPPROOFING. Insulation shall be kept dry prior to, during, and after installation. The cavity between the wythes shall not be filled with loose fill insulation.

3.4 WEEP HOLES

Weep holes shall be provided not more than 600 mm on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, through wall flashings, and any other horizontal interruptions of the cavity. Weep holes shall be formed by placing short lengths of well-greased No. 10, 8 mm nominal diameter, braided cotton sash cord in the mortar and withdrawing the cords after the wall has been completed or Weep holes shall be constructed using weep hole ventilators. Other approved methods may be used for providing weep holes. Weep holes shall be set above the base flashing as specified along with the mortar dropping collection device. The base flashing shall extend up the inner wythe a height of six inches above the mortar dropping collection device, or per manufacturers recommendations. Weep holes shall be kept free of mortar and other obstructions.

3.5 COMPOSITE WALLS

Masonry wythes shall be tied together with joint reinforcement or with unit wall ties. Facing shall be anchored to concrete backing with wire dovetail anchors set in slots built in the face of the concrete as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The facing wythe shall be anchored or tied to the backup at a maximum spacing of 400 mm on center vertically and 600 mm on center horizontally. Unit ties shall be spaced not over 600 mm on centers horizontally, in courses not over 400 mm apart vertically, staggered in alternate courses. Ties shall be laid not closer than 16 mm to either masonry face. Ties shall not extend through control joints. Collar joints between masonry facing and masonry backup shall be filled solidly with grout.

3.6 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least

3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

3.7 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 50 mm of tops of walls.

3.7.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 13 mm shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.7.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.8 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 400 mm on center or as indicated. Reinforcement shall be lapped not less than 150 mm. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 16 mm cover to either face of the unit.

3.9 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during

construction, the wall shall be torn down and rebuilt.

3.9.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 10 m apart, or as required, to limit the horizontal flow of grout for each pour.

3.9.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.9.3 Grout Holes and Cleanouts

3.9.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 400 mm on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 100 mm in diameter or 75 by 100 mm in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.9.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds 1.5 m. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 800 mm where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 75 by 100 mm openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.9.4 Grouting Equipment

3.9.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

3.9.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to

produce satisfactory consolidation without causing segregation.

3.9.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 1.5 m in height. High-lift grout methods shall be used on pours exceeding 1.5 m in height.

3.10 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 13 mm shall be maintained between reinforcement and interior faces of units.

3.11 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using special control-joint units and/or sash jamb units with control joint key in accordance with the details shown on the drawings. Sash jamb units shall have a 19 by 19 mm (3/4 by 3/4 inch) groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams except the floor levels (second floor, third floor etc.) or the roof level bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 20 mm; backer rod and sealant shall be installed in accordance with Section 07900 JOINT SEALING. Exposed interior control joints shall be raked to a depth of 6 mm. Concealed control joints shall be flush cut.

3.12 BRICK EXPANSION JOINTS AND CONCRETE MASONRY VENEER JOINTS

Brick expansion joints and concrete masonry veneer joints shall be provided and constructed as shown on the drawings. Joints shall be kept free of mortar and other debris.

3.13 SHELF ANGLES

Shelf angles shall be adjusted as required to keep the masonry level and at the proper elevation. Shelf angles shall be galvanized. Shelf angles shall be provided in sections not longer than 3 m and installed with a 6 mm gap between sections. Shelf angles shall be mitered and welded at building corners with each angle not shorter than 1.2 m, unless limited by wall configuration.

3.14 LINTELS

3.14.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 600 mm, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 13 mm above the bottom inside surface of the lintel unit.

3.14.2 Precast Concrete and Steel Lintels

Precast concrete lintels with the same dimensions, reinforcing, and bearing lengths may be used for cast-in-place concrete lintels shown on the drawings. Precast lintels shall have oversized holes (four times bay diameter) to thread jamb vertical reinforcing through. Epoxy grout space around reinforcing after lintel has been set. Precast concrete and steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of 200 mm unless otherwise indicated on the drawings.

3.15 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

3.16 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.16.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 400 mm on centers vertically and 600 mm on center horizontally.

3.16.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 400 mm on centers vertically, and if applicable, not over 600 mm on centers horizontally.

3.17 INSULATION

Anchored veneer walls shall be insulated, where shown, by installing board-type insulation on the cavity side of the inner wythe. Board type insulation shall be applied directly to the dampproofed masonry or thru-wall flashing with adhesive. Insulation shall be neatly fitted between obstructions without impaling of insulation on ties or anchors. The insulation shall be applied in parallel courses with vertical joints breaking midway over the course below and shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

3.18 SPLASH BLOCKS

Splash blocks shall be located as shown.

3.19 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed, painted, dampproofing insulated with board-type insulation, or covered with vinyl coated wallcovering. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

3.19.1 Concrete Masonry Unit Surfaces

Exposed concrete masonry unit surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.19.2 Clay or Shale Brick Surfaces

Exposed clay or shale brick masonry surfaces shall be cleaned as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, the sample panel of similar material shall be examined for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, the method of cleaning shall be changed to assure that the masonry surfaces in the structure will not be adversely affected. The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 30 mL trisodium phosphate and 30 mL laundry detergent to 1 L of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

3.20 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

3.21 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 600 mm down on each side of

the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.22 TEST REPORTS

3.22.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 13 to 16 mm thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

3.22.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 13.8 MPa at 28 days.

3.22.3 Efflorescence Test

Brick which will be exposed to weathering shall be tested for efflorescence. Tests shall be scheduled far enough in advance of starting masonry work to permit retesting if necessary. Sampling and testing shall conform to the applicable provisions of ASTM C 67. Units meeting the definition of "effloresced" will be subject to rejection.

3.22.3.1 Sealer

All exposed masonry (brick and split-face cmu) shall be sealed with "Prime A Pell 200" by Chemprobe after all masonry is installed and cleaned. Coverage Rate shall be determined by Technical Representative of product and the sample panel constructed on site. Refer to 09900 and 09915 for additional specifications

3.23 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

-- End of Section --

SECTION 07413A

METAL SIDING

10/01

Amendment No. 0001

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA Design Manual (2000) Aluminum Design Manual:
Specification & Guidelines for Aluminum
Structures

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl (1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463/A 463M (2000) Steel Sheet, Aluminum-Coated, by
the Hot-Dip Process

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated
(Galvanized) or Zinc-Iron Alloy-Coated
(Galvannealed) by the Hot-Dip Process

ASTM A 792/A 792M (1999) Steel Sheet, 55% Aluminum-Zinc
Alloy-Coated by the Hot-Dip Process

ASTM B 117 (1997) Operating Salt Spray (Fog) Testing
Apparatus

ASTM D 522 (1993a) Mandrel Bend Test of Attached
Organic Coatings

ASTM D 610 (1995) Evaluating Degree of Rusting on
Painted Steel Surfaces

ASTM D 714 (1987; R 1994e1) Evaluating Degree of
Blistering of Paints

ASTM D 968 (1993) Abrasion Resistance of Organic
Coatings by Falling Abrasive

ASTM D 1654 (1992) Evaluation of Painted or Coated
Specimens Subjected to Corrosive
Environments

- ASTM D 2244 (1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates
- ASTM D 2247 (1999) Testing Water Resistance of Coatings in 100% Relative Humidity
- ASTM D 2794 (1993; R 1999e1) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
- ASTM D 3359 (1997) Measuring Adhesion by Tape Test
- ASTM D 4214 (1998) Evaluating Degree of Chalking of Exterior Paint Films
- ASTM D 5894 (1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
- ASTM G 154 (2000a e1) Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
- AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
- ASCE 7 (1998) Minimum Design Loads for Buildings and Other Structures
- METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)
- MBMA Low Rise Bldg. Sys. Mnl. (1996) Low Rise Building Systems Manual

1.2 GENERAL REQUIREMENTS

1.2.1 Design

Criteria, loading combinations, and definitions shall be in accordance with ASCE 7. Maximum calculated fiber stress shall not exceed the allowable value in the AISI or AA manuals; a one third overstress for wind is allowed. Midspan deflection under maximum design loads shall be limited to L/180. Contract drawings show the design wind loads and the extent and general assembly details of the metal siding. Members and connections not shown on the drawings shall be designed by the Contractor. Siding panels and accessories shall be the products of the same manufacturer. Steel siding design shall be in accordance with AISI Cold-Formed Mnl. Aluminum siding design shall be in accordance with AA Design Manual.

1.2.2 Architectural Considerations

Panels profile shall be as shown on the drawings.

1.3 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:

SD-02 Shop Drawings

Siding; G, AE

Drawings consisting of catalog cuts, design and erection drawings, shop coating and finishing specifications, and other data as necessary to clearly describe design, materials, sizes, layouts, construction details, fasteners, and erection. Drawings shall be accompanied by engineering design calculations for the siding panels.

SD-04 Samples

Accessories

One sample of each type of flashing, trim, closure, cap and similar items. Size shall be sufficient to show construction and configuration.

Siding; G, AE

One piece of each type and finish (exterior and interior) to be used, 225 mm long, full width.

Fasteners

Two samples of each type to be used with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the jobsite shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Gaskets and Insulating Compounds

Two samples of each type to be used and descriptive data.

Sealant

One sample, approximately 0.5 kg, and descriptive data.

SD-07 Certificates

Siding
Installation
Accessories

Certificates attesting that the panels and accessories conform to the requirements specified. Certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than 5 pieces has been tested and has met the quality standards specified for factory color finish. Mill certification for structural bolts, siding, and wall liner panels.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage accommodations for metal siding shall provide good air circulation and protection from surface staining.

1.5 WARRANTIES

The Contractor shall provide a weather tight warranty for the metal siding for a period of 20 years to include siding panel assembly, 10 years against the wear of color finish, and 10 years against the corrosion of fasteners caused by ordinary wear and tear by the elements. The warranties shall start upon final acceptance of the work or the date the Government takes possession, whichever is earlier.

PART 2 PRODUCTS

2.1 SIDING

Panels shall be steel and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire height of any unbroken wall surface when length of run is 9 m or less. When length of run exceeds 9 m, each sheet in the run shall extend over two or more spans. Sheets longer than 9 m may be furnished if approved by the Contracting Officer. Width of sheets with interlocking ribs shall provide not less than 300 mm of coverage in place. Panels system shall be from the same manufacturer as the structural standing seam metal roof system.

2.1.1 Wall Panels

Wall panels shall have interlocking ribs for securing adjacent sheets. Wall panels shall be fastened to framework using concealed fasteners.

2.1.2 Steel Panels

Zinc-coated steel conforming to ASTM A 653/A 653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, **AZ 50 coating (Am#1)**; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 65. Uncoated wall panels shall be 0.6 mm thick minimum.

2.2 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated in

Section 09915 COLOR SCHEDULE. The exterior coating shall be a nominal 0.025 mm thickness consisting of a topcoat of not less than 0.018 mm dry film thickness and the paint manufacturer's recommended primer of not less than 0.005 mm thickness. (Am#1) The interior color finish shall consist of a backer coat with a dry film thickness of 0.013 mm . The exterior color finish shall meet the test requirements specified below.

2.2.1 Salt Spray Test

A sample of the sheets shall withstand a salt spray test for a minimum of 2016 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 8F, few No. 8 blisters, as determined by ASTM D 714; and a rating of 6, 3.0 mm failure at scribe, as determined by ASTM D 1654.

2.2.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 3 mm diameter mandrel, the coating film shall show no evidence of fracturing to the naked eye.

2.2.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM D 4587, test condition B for 1000 total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244.

2.2.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.2.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 13 mm diameter hemispherical head indenter, equal to 6.7 times the metal thickness in mm, expressed in Newton-meters, with no loss of adhesion.

2.2.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.3 ACCESSORIES

Flashing, trim, metal closure strips, caps, and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories

shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chlorided premolded to match configuration of the panels and shall not absorb or retain water.

2.4 FASTENERS

Fasteners for steel panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for attaching wall panels to supports shall provide both tensile and shear strength of not less than 3340 N per fastener. Fasteners for accessories shall be the manufacturer's standard. Nonpenetrating fastener system for wall panels using concealed clips shall be manufacturer's standard for the system provided.

2.4.1 Screws

Screws shall be as recommended by the manufacturer.

2.4.2 End-Welded Studs

Automatic end-welded studs shall be shouldered type with a shank diameter of not less than 5 mm and cap or nut for holding panels against the shoulder.

2.4.3 Explosive Actuated Fasteners

Fasteners for use with explosive actuated tools shall have a shank of not less than 3.68 mm with a shank length of not less than 13 mm for fastening panels to steel and not less than 25 mm for fastening panels to concrete.

2.4.4 Blind Rivets

Blind rivets shall be aluminum with 5 mm nominal diameter shank or stainless steel with 3 mm nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems shall have closed ends.

2.4.5 Bolts

Bolts shall be not less than 6 mm diameter, shouldered or plain shank as required, with proper nuts.

2.5 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be polyurethane based, be equal to siding panel in color, and shall cure to a rubberlike consistency.

2.6 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, panels with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Siding and Accessories

Siding shall be applied with the longitudinal configurations in the vertical position. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction. Siding installations shall coordinate with Section 07416 - STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM installation. Roofing and Metal Siding shall be from the same manufacturer.

3.1.1.1 Concealed Fastener Wall Panels

Panels shall be fastened to framing members with concealed fastening clips or other concealed devices standard with the manufacturer. Spacing of fastening clips and fasteners shall be in accordance with the manufacturer's written instructions. Spacing of fasteners and anchor clips along the panel interlocking ribs shall not exceed 300 mm on center except when otherwise approved. Fasteners shall not puncture metal sheets except as approved for flashing, closures, and trim; exposed fasteners for these situations shall be installed in straight lines. Interlocking ribs shall be sealed with factory-applied sealant. Joints at accessories shall be sealed.

-- End of Section --

SECTION 07416A

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
10/01
Amendment No. 0001

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Spec S335 (1989) Specification for Structural Steel Buildings - Allowable Stress Design, Plastic Design

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl (1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463/A 463M (2000) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 792/A 792M (1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM B 117 (1997) Operating Salt Spray (Fog) Testing Apparatus

ASTM C 518 (1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

ASTM C 1289 (2002) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

ASTM D 522 (1993a) Mandrel Bend Test of Attached Organic Coatings

ASTM D 523 (1989; R 1999) Specular Gloss

- ASTM D 610 (1995) Evaluating Degree of Rusting on Painted Steel Surfaces
- ASTM D 714 (1987; R 1994e1) Evaluating Degree of Blistering of Paints
- ASTM D 968 (1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
- ASTM D 1308 (1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- ASTM D 1654 (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
- ASTM D 2244 (1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates
- ASTM D 2247 (1999) Testing Water Resistance of Coatings in 100% Relative Humidity
- ASTM D 2794 (1993; R 1999e1) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
- ASTM D 3359 (1997) Measuring Adhesion by Tape Test
- ASTM D 4214 (1998) Evaluating Degree of Chalking of Exterior Paint Films
- ASTM D 5894 (1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)
- ASTM E 84 (2000a) Surface Burning Characteristics of Building Materials
- ASTM E 903 (1996) Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
- ASTM E 1592 (1998) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
- ASTM G 154 (2000ae1) Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
- AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
- ASCE 7 (1998) Minimum Design Loads for Buildings

and Other Structures

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA Low Rise (1996) Low Rise Building Systems Manual
Bldg. Sus. Mnl.

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION
(SMACNA)

SMACNA-02 (1993; Errata) Architectural Sheet Metal
Manual

STEEL JOIST INSTITUTE (SJI)

SJI Specs & Tables (1994) Standard Specifications Load Tables
and Weight Tables for Steel Joists and
Joist Girders

1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

1.2.1 Structural Standing Seam Metal Roof (SSSMR) System

The SSSMR system covered under this specification shall include the entire roofing system; the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system.

1.2.2 Manufacturer

The SSSMR system shall be the product of a manufacturer who has been in the practice of manufacturing and designing SSSMR systems for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

1.2.3 Installer

The installer shall be certified by the SSSMR system manufacturer to have experience in installing the furnished roof system on at least three other projects that are of comparable size, scope and complexity as this project. The installer may be either employed by the manufacturer or be an independent installer.

1.3 DESIGN REQUIREMENTS

The design of the SSSMR system shall be provided by the Contractor as a complete system. Members and connections not indicated on the drawings, but required for the system to function, shall be designed by the Contractor. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

1.3.1 Design Criteria

Design criteria shall be in accordance with ASCE 7.

1.3.2 Dead Loads

The dead load shall be the weight of the SSSMR system. Collateral loads such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.

1.3.3 Live Loads

1.3.3.1 Concentrated Loads

The panels and anchor clips shall be capable of supporting a 1335 N concentrated load. The concentrated load shall be applied at the panel midspan and will be resisted by a single standing seam metal roof panel assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

1.3.3.2 Uniform Loads

The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of 960 Pa.

1.3.4 Wind Loads

The design wind uplift pressure for the roof system shall be computed and applied using a basic speed of 90 mph, and importance factor of 1 (one) and exposure factor of C. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when figuring fastener design loads.

- a. Single fastener in each connection.....3.0
- b. Two or more fasteners in each connection...2.25

1.3.5 Thermal Loads

Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 104 degrees C (220 degrees F) during the life of the structure.

1.3.6 Framing Members Supporting the SSSMR System

Any additions/revisions to framing members supporting the SSSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. New or revised framing members and their connections shall be designed in

accordance with AISI Cold-Formed Mnl. Maximum deflection under applied live load, or wind load shall not exceed 1/180 of the span length.

1.3.7 Roof Panels Design

Steel panels shall be designed in accordance with AISI Cold-Formed Mnl. The structural section properties used in the design of the panels shall be determined using the unloaded shape of the roof panels. The calculated panel deflection from concentrated loads shall not exceed 1/180 of the span length. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length. Deflections shall be based on panels being continuous across three or more supports. Deflection shall be calculated and measured along the major ribs of the panels.

1.3.8 Accessories and Their Fasteners

Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. There shall be a minimum of two fasteners per clip. Single fasteners with a minimum diameter of 9 mm will be allowed when the supporting structural members are prepunched or predrilled.

1.4 PERFORMANCE REQUIREMENTS

The SSSMR shall be tested for wind uplift resistance in accordance with ASTM E 1592; SSSMR systems previously tested and approved by the Corps of Engineers' STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE may be acceptable. Two tests shall be performed. Test 1 shall simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. The maximum span length for the edge condition shall be 750 mm. Test 2 shall simulate the interior condition with both ends free of crosswise restraint. The maximum span length for the interior condition shall be 1.5 m. External reinforcement, such as clamps on the ribs, shall not be installed to improve uplift resistance. Bolts through seams shall not be installed. Full scale testing is required to verify the adequacy of the SSSMRS. Once a SSSMRS manufacturer is found to be adequate for a specific loading condition, that certification may be used for future projects, as long as no changes are made in the system components.

1.5 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:

SD-02 Shop Drawings

Structural Standing Seam Metal Roof System; G, AE.

Metal roofing drawings and specifications and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for

thermal movement, line of panel fixity, fastener sizes and spacings, sealants and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's proprietary products and fabricated items as required. The SSSMR system shop drawings shall be provided by the metal roofing manufacturer.

SD-03 Product Data

Design Analysis; G, AE.

Design analysis signed by a Registered Professional Engineer employed by the SSSMR manufacturer. The design analysis shall include a list of the design loads, and complete calculations for the support system (when provided by the Contractor), roofing system and its components; valley designs, gutter/downspout calculations, screw pullout test results, and shall indicate how expected thermal movements are accommodated.

Qualifications; G, AE.

Qualifications of the manufacturer and installer. Provide the following information; Project Name, roof system, name and phone number of owner contact, and description of roof complexity (e.g. valleys, dormers, multi-level, etc...)

SD-04 Samples

Accessories; G, AE.

One sample of each type of flashing, trim, closure, thermal spacer block, cap and similar items. Size shall be sufficient to show construction and configuration.

Roof Panels; G, AE.

One piece of each type to be used, 225 mm long, full width.

Factory Color Finish; G, AE.

Three 75 by 125 mm samples of each type and color.

Fasteners.

Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Insulation; .

One piece, 300 by 300 mm, of each type and thickness to be used, with a label indicating the rated permeance (if faced) and R-values. The flame spread, and smoke developed rating shall be shown on the label or provided in a letter of certification.

Gaskets and Insulating Compounds.

Two samples of each type to be used and descriptive data.
Sealant.

One sample, approximately 0.5 kg, and descriptive data.
Concealed Anchor Clips.

Two samples of each type used.
Subpurlins.

One piece, 225 mm long.
EPDM Rubber Boots.

One piece of each type.

SD-06 Test Reports

Test Report for Uplift Resistance of the SSSMR; G, AE.

The report shall include the following information:

- a. Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.
- b. Details of the anchor clip, dimensions, and thickness.
- c. Type of fasteners, size, and the number required for each connection.
- d. Purlins/subpurlins size and spacing used in the test.
- e. Description of the seaming operation including equipment used.
- f. Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.
- g. Any additional information required to identify the SSSMR system tested.
- h. Signature and seal of an independent registered engineer who witnessed the test.

SD-07 Certificates

Structural Standing Seam Metal Roof System.

- a. Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips complies with specified requirements.
- b. Certification that materials used in the installation are mill certified.

c. Previous certification of SSSMR system tested under the Corps of Engineers' Standard Test Method in lieu of ASTM E 1592 testing.

d. Certification that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than three pieces has been tested and has met the quality standards specified for factory color finish.

e. Certification of installer. Installer certification shall be furnished.

f. Warranty certificate.

(1) Submit samples of Contractor's Weathertightness Warranty bond, 20-year Manufacturer's Material Warranties, and Manufacturer's 20-year system weathertightness warranty.

(2) At the completion of the project the Contractor shall furnish signed copies of the 5-year Warranty for Structural Standing Seam Metal Roof (SSSMR) System, a sample copy which is attached to this section, 5-year Weathertightness Warranty Bond, and the 20-year system weathertightness warranty.

Insulation; G, AE.

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage conditions shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The SSSMR system shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

1.7.1 Contractor's Weathertightness Warranty

The SSSMR system shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The SSSMR system covered under this warranty shall include the entire roofing system including, but not limited to, the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, and gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of these specifications

that are part of the SSSMR system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM, and shall start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire SSSMR system as outlined above.

1.7.2 Manufacturer's Material Warranties.

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all SSSMR system components such as roof panels, anchor clips and fasteners, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's non-prorated 20 year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material. Replacement shall include shipping costs and all material and labor costs involved in the physical replacement of failed material.

b. A manufacturer's non-prorated 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change color in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing with an air-drying version of the specified finish or replacing the defective coated material.

c. A roofing system manufacturer's non-prorated, 20 year system weathertightness warranty.

1.8 COORDINATION MEETING

A coordination meeting shall be held 30 days prior to the first submittal, for mutual understanding of the Structural Standing Seam Metal Roof (SSSMR) System contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roof system manufacturer, the roofing supplier, the erector, the SSSMR design engineer of record, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall

coordinate time and arrangements for the meeting.

PART 2 PRODUCTS

2.1 ROOF PANELS

Panels shall be steel and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed . Width of sheets shall provide not more than 400 mm of coverage in place. SSSMR system with roofing panels greater than 300 mm in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than 50 mm . Wall Panel System as specified in Section 07413 - METAL SIDING shall be provided by the SSSMRS manufacturer.

2.1.1 Steel Panels

Steel panels shall be zinc-coated steel conforming to ASTM A 653/A 653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ 50 coating; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 65. Zinc, zinc-aluminum alloy or aluminum coated panels shall be 0.584 mm thick minimum. Panels shall be within 95 percent of reported tested thickness as noted in wind uplift resistance testing required in paragraph PERFORMANCE REQUIREMENTS.

2.2 CONCEALED ANCHOR CLIPS

Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip.

2.3 ACCESSORIES

Flashing, trim, metal closure strips, caps and similar metal accessories shall be the manufacturer's standard products, with the exception that their metal thickness shall match that of the panels furnished. Exposed metal accessories shall have the same finish systems as the panels furnished. Molded closure strips shall be closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water. The use of a continuous angle butted to the panel ends to form a closure will not be allowed.

2.4 FASTENERS

Fasteners for steel roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for structural connections shall provide both tensile and shear ultimate load resistance of not less than 3340 N per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the roof to waterproof the fastener penetration. Washer material shall be compatible with the roofing; have a minimum diameter of 10 mm for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 3 mm thick. Exposed fasteners for factory color finished panels shall be

factory finished to match the color of the panels.

2.4.1 Screws

Screws for attaching anchor devices shall be not less than No. 14. Actual screw pull out test results shall be performed for the actual material gage and yield strength of the structural purlins or subpurlins to which the clip is to be anchored/attached. Other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

2.4.2 Bolts

Bolts shall be not less than 6 mm diameter, shouldered or plain shank as required, with locking washers and nuts.

2.4.3 Structural Blind Fasteners

Blind screw-type expandable fasteners shall be not less than 6 mm diameter. Blind (pop) rivets shall be not less than 3 mm minimum diameter.

2.5 PURLINS and SUBPURLINS

Cold formed supporting structural members/subpurlins shall have a minimum thickness of 1.5 mm and a minimum tensile yield strength of 345 MPa. Hot rolled structural members shall have a minimum thickness of 6 mm and a minimum tensile yield strength of 248 MPa. Purlins and subpurlins shall be shop painted.

2.6 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated in Section 09915 COLOR SCHEDULE. The exterior coating shall be a nominal 0.025 mm thickness consisting of a topcoat of not less than 0.018 mm dry film thickness and the paint manufacturer's recommended primer of not less than **0.005 mm thickness. (Am#1)** The interior color finish shall consist of a backer coat with a dry film thickness of 0.013 mm. The exterior color finish shall meet the test requirements specified below.

2.6.1 Salt Spray Test

A sample of the sheets shall withstand a salt spray test for a minimum of 2016 hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 8F, few No. 8 blisters, as determined by ASTM D 714; and a rating of 6, 3.0 mm failure at scribe, as determined by ASTM D 1654.

2.6.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 3 mm diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

2.6.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM D 4587, test condition B for 1000 total hours. The coating shall withstand the

weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (ΔE) units in accordance with ASTM D 2244.

2.6.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

2.6.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 13 mm diameter hemispherical head indenter, equal to 6.7 times the metal thickness in mm, expressed in Newton-meters, with no cracking.

2.6.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.6.7 Specular Gloss

Finished roof surfaces shall have a specular gloss value of 30 plus or minus 5 at 60 degrees when measured in accordance with ASTM D 523.

2.6.8 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.6.8.1 Solar Reflectance

Coating shall have an initial solar reflectance greater than or equal to 0.25 when tested in accordance with the procedures in ASTM E 903. After 3 years of outdoor exposure, coating shall have a solar reflectance greater than or equal to 0.15. (ENERGY STAR Roof compliant for high-reflectance and low emissivity roofing)

2.7 INSULATION

Long-term thermal resistance (LTTR) of polyisocyanurate insulation shall be not less than 21.3 hour x square feet x degree F/BTU. LTTR shall be determined in accordance with practice and details in Annex A1 of ASTM C 1289. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation, including facings, shall have a flame spread not in excess of 75 and a smoke developed rating not in excess of 450 when tested in accordance with ASTM E 84.

2.7.1 Polyisocyanurate Rigid Board Insulation for Use Above a Roof Deck

Polyisocyanurate insulation shall conform to ASTM C 1289, Type II, Class 2, (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). Facings shall be non-asphaltic, glass fiber mat.

2.7.2 Blanket Insulation

Blanket insulation shall conform to ASTM C 991, Type I (unfaced), and shall not be computed in the R-Value of the roof but provided for reasons as noted in paragraph 3.2.1.

2.8 STEEL SUPPORT PLATES

Steel support plates (e.g. at valleys, ridges, or hips) shall be a minimum of 16 gauge.

2.9 SEALANT

Sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall be polyurethane based, colored to match the roof in color and shall cure to a rubberlike consistency. Polyurethane sealant manufacturer's recommended cleaner and primer shall be applied to polyvinylidene fluoride painted surfaces before sealant is applied. Factory-installed sealant shall be provided in the standing seam ribs and panel clips.

2.10 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

2.11 RUBBER BOOTS

Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Silicone boots shall be used on hot stacks or vents. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

2.12 PREFABRICATED CURBS AND EQUIPMENT SUPPORTS

Prefabricated curbs and equipment supports shall be of structural quality, galvanized sheet steel or aluminum, with mitered and welded joints. Finish shall be the same as provided on the roof panels. Integral base plates and water diverter crickets shall be provided. Minimum height of curb shall be 200 mm above finish roof. Curbs shall be constructed to match roof slope and to provide a level top surface for mounting of equipment. Curb flange shall be constructed to match configuration of roof panels. Curb size shall be coordinated, prior to curb fabrication, with the mechanical equipment to be supported. Strength requirements for equipment supports shall be coordinated to include all anticipated loads. Flashings shall not be rigidly attached to underlying structure so as to not restrict the thermal movement of adjacent roof planes..

2.12.1 GUTTERS AND DOWNSPOUTS

Provide 24 Ga. minimum gutters, conductor heads, and downspouts per drawings of the same material, color, and finish as the SSSMR system roof panels. Detail per SMACNA-02.

2.13 UNDERLAYMENTS

2.13.1 Rubberized Underlayment

Rubberized underlayment shall be equal to TW Metal and Tile Underlayment by TAMKO WATERPROOFING or "Metal Mate" manufactured by Building Materials Corporation of America. Underlayment shall be resistant to damage from UV radiation for a minimum of 60 days when exposed to the weather.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Molded closure strips shall be installed wherever roofing sheets terminate in open-end configurations, exclusive of flashings. The closure strip installation shall be weather-tight and sealed. Screws shall be installed with a clutching screw gun, to assure screws are not stripped. Field test shall be conducted on each gun prior to starting installation and periodically thereafter to assure it is adjusted properly to install particular type and size of screw as recommended by manufacturer's literature. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

3.1.1 Field Forming of Panels will not be permitted.

3.1.2 Purlins and Subpurlins

Unless otherwise shown, purlins and subpurlins shall be anchored to the structural framing members with bolts or screws. Attachment to the substrate (when provided) or to the panels is not permitted. The purlin spacing shall not exceed 750 mm on centers at the corner, edge and ridge zones, and 1500 mm maximum on centers for the remainder of the roof. Corner, edge, and ridge zones are as defined in ASCE 7 Purlins shall be adjusted so that their tops are in the same approximate plane. Planeness tolerance shall be as recommended by the panel system manufacturer..

3.1.3 Roof Panel Installation

Roof panels shall be installed with the standing seams in the direction of

the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation. End laps of panels shall be provided in accordance with the manufacturer's instructions. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings. Fasteners shall not puncture roofing sheets except as provided for in the manufacturer's instructions for erection and installation. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings and other locations indicated on the manufacturer's drawings. Roof panel installation shall coordinate with Section 07413 - METAL SIDING installation.

3.1.4 Concealed Anchor Clips

Concealed anchor clips shall be fastened directly to the structural framing members. Attachment to the substrate (when provided) or to the metal deck is not permitted. The maximum distance, parallel to the seams, between clips shall be 750 mm on center at the corner, edge, and ridge zones, and 1500 mm maximum on centers for the remainder of the roof.

3.2 INSULATION INSTALLATION

Insulation shall be continuous over entire roof surface. Where expansion joints, terminations, and other connections are made, the cavity shall be filled with batt insulation with vapor retarder providing equivalent R-value and perm rating as remaining insulation. Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

3.2.1 Board Insulation with Blanket Insulation

Rigid board insulation shall be laid in close contact. Board shall be attached to the metal roof deck with bearing plates and fasteners, as recommended by the insulation manufacturer, so that the insulation joints are held tight against each other, and shall have a minimum of 1 fastener per 0.37 square meters. Layout and joint pattern of insulation and fasteners shall be indicated on the shop drawings. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. Selected thickness of insulation shall be such that it's top surface shall be in plane with tops of purlins. A layer of blanket insulation shall be placed over underlayment adhered to the rigid board insulation and compressed against the underside of the metal roofing to reduce thermal bridging, dampen noise, and prevent roofing flutter. This layer of blanket insulation shall be compressed a minimum of 50 percent.

3.3 GUTTERS AND DOWNSPOUTS

Gutters and downspouts shall be installed as indicated. Gutters shall be supported by continuous cleats. Downspouts shall be rigidly attached to the building. Supports shall be spaced according to manufacturer's recommendations.

3.4 UNDERLAYMENT

Install rubberized underlayment at all roof edges, hips, valleys and under all roof panels. Install directly over the board insulation and purlins, beneath the metal roof panels. All underlayment shall be installed so that

successive strips overlap the next lower strip in shingle fashion. Underlayment shall be installed in accordance with manufacturer's written instructions. The underlayment shall ensure that any water that penetrates below the metal roofing panels will drain outside the building envelope.

3.5 CUTTING OF PREFINISHED GALVALUME-COATED STEEL

Cutting of prefinished galvalume-coated steel shall be accomplished only with tools that shear the metal, such as full-panel shears, nibblers, and manual and electric tin snips. Abrasive blade, circular metal blade, and power or hand hacksaw or jigsaw blade cutting will not be acceptable.

3.6 OIL CANNING AND WRINKLING

Oil canning or wrinkling caused by out-of-plane purlins, out-of-adjustment mechanical seamer, hand or mechanical seaming of out-of-module panels, or restriction of thermal movement of panels will be cause for rejection of affected panels.

3.7 CLEANING AND TOUCH-UP

Exposed SSSMR systems, including gutters and downspouts, shall be cleaned during and at completion of installation. Debris (e.g. metal particles) that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint, using a fine artist brush. Application of paint with a broad brush will be cause for rejection of affected panels, flashing, or accessories..

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

FACILITY DESCRIPTION _____

BUILDING NUMBER: _____

CORPS OF ENGINEERS CONTRACT NUMBER: _____

CONTRACTOR

CONTRACTOR: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

OWNER

OWNER: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

CONSTRUCTION AGENT

CONSTRUCTION AGENT: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

THE SSSMR SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH ASTM E 1592. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE SSSMR SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President)

(Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE SSSMR SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE SSSMR SYSTEM DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE SSSMR SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

**

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
(continued)

**REPORTS OF LEAKS AND SSSMR SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE SSSMR SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

SECTION 08520A

ALUMINUM WINDOWS
03/00Amendment No. 0001

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101 (1997) Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283 (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E 330 (1997e1) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

ASTM E 331 (1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

ASTM E 413 (1987; R 1999) Rating Sound Insulation

ASTM E 547 (1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential

ASME INTERNATIONAL (ASME)

ASME A39.1 (1995; A39.1a; A39.1b) Safety Requirements for Window Cleaning

INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

ISWA IWS 089 (1990) Recommended Standards and Specifications for Insect Wire Screening (Wire Fabric)

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100 (1997) Procedure for Determining Fenestration Product U-factors

NFRC 200 (1997) Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (1997; Errata 97-1; TIA-97-1) Life Safety Code

SCREEN MANUFACTURERS ASSOCIATION (SMA)

SMA ANSI/SMA 1004 (1987) Aluminum Tubular Frame Screens for Windows

1.2 WINDOW PERFORMANCE

Aluminum windows shall meet the following performance requirements. Testing requirements shall be performed by an independent testing laboratory or agency.

1.2.1 Structural Performance

Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with ASTM E 330. After testing, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There shall be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA 101 for the window types and classification specified in this section.

1.2.2 Air Infiltration

Air infiltration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 283.

1.2.3 Water Penetration

Water penetration shall not exceed the amount established by AAMA 101 for each window type when tested in accordance with ASTM E 547.

1.2.4 Thermal Performance

Thermal transmittance for thermally broken aluminum windows with insulating glass shall not exceed a U-factor of 4.3 W/m²K (0.75 Btu/hr-ft²-F) determined according to NFRC 100, and a solar heat gain coefficient (SHGC) of 2.3 W/m²K (0.40 Btu/hr-ft²-F) determined according to NFRC 200. Window

units shall comply with the U.S. Department of Energy, Energy Star Window Program for the Southern Climate Zone.

1.2.5 Life Safety Criteria

Windows shall conform to NFPA 101 Life Safety Code when rescue and/or second means of escape are indicated.

1.2.6 Sound Attenuation

The window unit shall have a minimum STC of 41 with the window glazed with two pieces of 6 mm thick laminated glass when tested in accordance with ASTM E 90 and ASTM E 413.

1.3 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:

SD-02 Shop Drawings

Aluminum Windows
Insect Screens

Drawings indicating elevations of window, rough-opening dimensions for each type and size of window, full-size sections, thicknesses of metal, fastenings, methods of installation and anchorage, connections with other work, type of wall construction, size and spacing of anchors, method of glazing, types and locations of operating hardware, mullion details, weatherstripping details, and window schedules showing locations of each window type.

SD-03 Product Data

Aluminum Windows

Manufacturer's descriptive data and catalog cut sheets.

SD-04 Samples

Aluminum Windows

Manufacturer's standard color samples of the specified finishes.

SD-06 Test Reports

Aluminum Windows

Reports for each type of aluminum window attesting that identical windows have been tested and meet all performance requirements established under paragraph WINDOW PERFORMANCE.

SD-07 Certificates

Aluminum Windows

Certificates stating that the aluminum windows are AAMA certified conforming to requirements of this section. Labels or markings permanently affixed to the window will be accepted in lieu of certificates. Product ratings determined using NFRC 100 and NFRC 200 shall be authorized for certification and properly labeled by the manufacturer.

1.4 QUALIFICATION

Window manufacturer shall specialize in designing and manufacturing the type of aluminum windows specified in this section, and shall have a minimum of 20 years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.5 MOCK-UPS

Before fabrication, full-size mock-up of each type of aluminum window complete with glass and AAMA certification label for structural purposes and NFRC Temporary and Permanent Label for certification of thermal performance rating will be required for review of window construction and quality of hardware operation.

1.6 DELIVERY AND STORAGE

Aluminum windows shall be delivered to project site and stored in accordance with manufacturer's recommendations. Damaged windows shall be replaced with new windows.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

PART 2 PRODUCTS

2.1 ALUMINUM WINDOW TYPES

Aluminum windows shall consist of complete units including sash, glass, frame, weatherstripping, and hardware. Windows shall conform to AAMA 101. Windows shall be double-glazed. Operable windows shall permit cleaning the outside glass from inside the building.

2.1.1 Double-Hung Windows

Aluminum double-hung (H) windows shall conform to AAMA 101 H-C30 type which operate vertically with the weight of sash offset by a counterbalancing mechanism mounted in window to hold the sash stationary at any open position. Windows shall be provided with a tilt-in sash.

2.1.2 Fixed Windows

Aluminum fixed (F) windows shall conform to AAMA 101 F-C30 type, non-operable glazed frame, complete with provisions for reglazing in the field.

2.1.3 Horizontal-Sliding Windows

Aluminum horizontal (HS) sliding windows shall conform to AAMA 101 HS-C30 type consisting of sliding sash and fixed lite. Sash guides shall be nylon wheels. Windows shall be provided with locking devices to secure the sash in the closed position.

2.2 WEATHERSTRIPPING

Weatherstripping for ventilating sections shall be of type designed to meet water penetration and air infiltration requirements specified in this section in accordance with AAMA 101, and shall be manufactured of material compatible with aluminum and resistant to weather. Weatherstrips shall be factory-applied and easily replaced in the field. Neoprene or polyvinylchloride weatherstripping are not acceptable where exposed to direct sunlight.

2.3 INSECT SCREENS

Insect screens shall be aluminum window manufacturer's standard design, and shall be provided where scheduled on drawings. Insect screens shall be fabricated of roll-formed extruded tubular-shaped aluminum frames conforming to SMA ANSI/SMA 1004 and (18 x 16) aluminum mesh screening conforming with ISWA IWS 089, Type III (Am#1)

2.4 ACCESSORIES

2.4.1 Fasteners

Fastening devices shall be window manufacturer's standard design made from aluminum, non-magnetic stainless steel, cadmium-plated steel, nickel/chrome-plated steel in compliance with AAMA 101. Self-tapping sheet metal screws will not be acceptable for material thicker than 2 mm

2.4.2 Hardware

Hardware shall be as specified for each window type and shall be fabricated of aluminum, stainless steel, cadmium-plated steel, zinc-plated steel or nickel/chrome-plated steel in accordance with requirements established by AAMA 101.

2.4.3 Window Anchors

Anchoring devices for installing windows shall be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA 101.

2.5 GLASS AND GLAZING

Aluminum windows shall be designed for inside glazing, field glazing, and for glass types scheduled on drawings and specified in Section 08810 GLASS AND GLAZING. Units shall be complete with glass and glazing provisions to meet AAMA 101. Glazing material shall be compatible with aluminum, and shall not require painting.

2.6 FINISH

2.6.1 Anodized Aluminum Finish

Exposed surfaces of aluminum windows and screens shall be finished with anodic coating conforming to AA DAF-45: Architectural Class I, AA-M10-C22-A44, color anodic coating, 0.02 mm (0.7 mil) or thicker. Finish shall be free of scratches and other blemishes.

2.6.2 Color

Color shall be in accordance with Section 09915 COLOR SCHEDULE.

PART 3 EXECUTION

3.1 INSTALLATION

Aluminum windows shall be installed in accordance with approved shop drawings and manufacturer's published instructions. Aluminum surfaces in contact with masonry, concrete, wood and dissimilar metals other than stainless steel, zinc, cadmium or small areas of white bronze, shall be protected from direct contact using protective materials recommended by AAMA 101. The completed window installation shall be watertight in accordance with Section 07900 JOINT SEALING. Glass and glazing shall be installed in accordance with requirements of this section and Section 08810 GLASS AND GLAZING.

3.2 ADJUSTMENTS AND CLEANING

3.2.1 Hardware Adjustments

Final operating adjustments shall be made after glazing work is complete. Operating sash or ventilators shall operate smoothly and shall be weathertight when in locked position.

3.2.2 Cleaning

Aluminum window finish and glass shall be cleaned on exterior and interior sides in accordance with window manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring window finish and glass surfaces.

-- End of Section --

SECTION 09915

COLOR SCHEDULE

06/93
AM 0001

PART 1 GENERAL

1.1 GENERAL

This section covers only the color of the exterior and interior materials and products that are exposed to view in the finished construction. The word "color" as used herein includes surface color and pattern. Requirements for quality and method of installation are covered in other appropriate sections of the specifications. Specific locations where the various materials are required are shown on the drawings. Items not designated for color in this section may be specified in other sections. When color is not designated for items, the Contractor shall propose a color for approval.

1.2 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:

SD-04 Samples

Color Schedule; G

THREE (3) sets of color boards, 120 days after the Contractor is given Notice to proceed, complying with the following requirements:

a. Color boards shall reflect all actual finish textures, patterns, and colors required for this contract.

b. Materials shall be labeled with the finish type, manufacturer's name, pattern, and color reference.

c. Samples shall be on size A4 or 8-1/2 by 11 inch boards with a maximum spread of size A1 or 25-1/2 by 33 inches for foldouts.

d. Samples for this color board are required in addition to samples requested in other specification sections.

e. Color boards shall be submitted to the following addresses: for approval to:

Design Branch
Architectural Section
Fort Worth District

PART 2 PRODUCTS

2.1 REFERENCE TO MANUFACTURER'S COLOR

Where color is shown as being specific to one manufacturer, an equivalent color by another manufacturer may be submitted for approval. Manufacturers and materials specified are not intended to limit the selection of equal colors from other manufacturers.

2.2 COLOR SCHEDULE

The color schedule lists the colors, patterns and textures required for exterior and interior finishes, including both factory applied and field applied colors.

2.2.1 Exterior Walls

Exterior wall colors shall apply to exterior wall surfaces including recesses at entrances and projecting vestibules. Conduit shall be painted to closely match the adjacent surface color. Wall color shall be provided to match the colors listed below.

- a. Brick:
Acme; Doe Skin
- b. Mortar:
Standard Grey
- c. Metal Siding:
Match MBCI Brownstone
- d. Split Face:
Featherlite, 707 Apache Brown
- f. Insulation and Finish System: SUB STATION, CENTRAL CHILLER PLANT;
SOFFITT
STO; 20 905
- g. Coping
To match Acme Brick, Doe Skin
- h. Smooth Face CMU:
Featherlite, 708 Apache Brown

2.2.2 Exterior Trim

Exterior trim shall be provided to match the colors listed below.

- a. Doors and Door Frames: ALL METAL/ALUMINUM
T101; Manufacturer's Standard Medium Bronze
- b. Windows (mullion, muntin, sash, trim, and sill):
W101; Manufacturer's Standard Medium Bronze
- c. Glazed Ceramic Tile:
Dal-tile; Porcealto, Ossidiana CD85, 200x200mm

- d. Fascia:
Manufacturer's Standard Color to Match Standing Seam Metal Roof; MBCI, Brownstone
- e. Downspouts, Gutter, Louvers, and Flashings:
Manufacturer's Standard Color to Match Standing Seam Metal Roof; MBCI, Brownstone.
- f. Guardrails:
To Match Sherwin Williams Black Magic, SW6991
- g. Soffits and Ceilings:
STO; 20 905
- h. Signage:
Base Standard
- j. Caulking and Sealants:
To Match Adjacent Material

2.2.3 Exterior Roof

Roof color shall apply to exterior roof surfaces including sheet metal flashings and copings, mechanical units, roof trim, pipes, conduits, electrical appurtenances, and similar items. Roof color shall be provided to match the colors listed below.

- a. Metal:
MBCI; Brownstone, Manufacturer's Standard Color
- b. Miscellaneous Metals: All Miscellaneous Metal shall match Roof; MBMCI, Brownstone

2.2.4 Interior Floor Finishes

Flooring materials shall be provided to match the colors listed below.

- b. Carpet Tile:
F101; Interface, Frequency, 2618 Pulse
- c. Vinyl Composition Tile:
F201; Armstrong, Safety Zone, Slip-Retardant Tile, 57008 Soft Cedar
- d. Solid Vinyl:
F701; Armstrong, Natural Options Stone, T118 Camaro Sand Beige, 600x600mm
- g. Quarry Tile:
F501; Dal-tile, Quarry tile, Red Blaze Q40, 150x150mm

reveals, vertical furred spaces, grilles, diffusers, electrical and access panels, and piping and conduit adjacent to wall surfaces unless otherwise specified. Items not specified in other paragraphs shall be painted to match adjacent wall surface. Wall materials shall be provided to match the colors listed below.

a. Paint:

W101; Polymyx, P2L-C1185
W102; Sherwin Williams, Buckram Binding 0036
W103; Sherwin Williams, Mega Greige SW 7031

b. Vinyl Wall Covering:

W201; Kenmark, Evan & Brown, Reedo, Granymeade R221-83
W202; Maharam, TexWall, Trance 395660, Terracotta 003
AM#1 W203; Kenmark, Anya Larkin, Ceremony, Stardust **AM#1 MC21-32**

d. Ceramic Tile:

W301; Dal-tile, Keystones, Goldust D138, 50x50mm
W302; Dal-tile, Semi-Gloss, Golden Granite 0138, 150x150mm
W701; Mural, Dal-tile "Army Pride"
W701; Mural, Dal-tile "Defend America"

*NOTE; FOR W701 & W702 SEE ARCH DRWG A-A503

SHOWER STALLS IN COMPANY OPERATIONS BUILDING

Floor; Dal-tile, Keystones, Mexican Sand Speckle D175
Walls: Dal-tile, Keystone, Fawn D136, 94%
Dal-tile, Sonterra Collection, Terracotta SR78, 6%

*NOTE; WALL IN SHOWER TO BE INSTALLED IN DAL-TILE PATTERN 2008

e. Ceramic Tile Grout:

Mapei; 42 Moka for W301
Mapei; 00 White for W302

f. Porcelain Tile:

W401; Dal-tile, Terra Antica, TA03 Bruno, 150x150mm
W402; Dal-tile, Terra Antica, Bruno TA03, Border

2.2.7 Interior Ceiling Finishes

Ceiling colors shall apply to ceiling surfaces including soffits, furred down areas, grilles, diffusers, registers, and access panels. Ceiling color shall also apply to joist, underside of roof deck, and conduit and piping where joists and deck are exposed and required to be painted.

Ceiling materials shall be provided to match the colors listed below.

- a. Acoustical Tile and Grid:
C101; Armstrong, Ultima, Beveled Tegular, White
w/ Prelude 14mm Exposed Tee Grid, White
- b. Paint:
C201; Sherwin Williams, Biscuit SW6112
- c. Structural Framing:
C201; Sherwin Williams, Biscuit SW6112

2.2.8 Interior Trim

Interior trim shall be provided to match the colors listed below.

- a. Doors:
Wood; Natural Clear Stain
Metal; Manufacturer's Standard Med. Bronze
- b. Door Frames:
Wood; Natural Clear Stain
Metal; Manufacturer's Standard Med. Bronze
- c. Windows (mullion, muntin, sash, trim, and stool):
Wood; Natural Clear Stain
Metal; Manufacturer's Standard Med. Bronze
- d. Window Sills:
AM#1 REPLACE Avanza, Ranzano Nuovo 1605
WITH SILESTONE, COFFE BRWON 1302
- e. Fire Extinguisher Cabinets:
Potter-Roemer; Model #7010- White

2.2.9 Interior Window Treatment

Window treatments shall be provided to match the colors listed below.

- a. Horizontal Blinds:
Barrack Rooms
Levolor; Riviera Series, 364 Pebble, 50mm
- b. Window Shades:
Soldier Community Building
Company Ops Building
Mecho, Euro-Veil, Bronze, 5313

*Note; To be installed on all exterior windows.

2.2.10 Interior Miscellaneous

Miscellaneous items shall be provided to match the colors listed below.

- a. Toilet Partitions and Urinal Screen:
M101; Santana; 590
- b. Plastic Laminate:
Soldier Comm. Building
Countertop in Laundry A110 and Pass Thru Mail Room A111
PL-1; Wilsonart, Burnished Chestnut 4796-60

*NOTE; See Arch Drwg. A-A104 for details

Barracks

Countertop in Kitchen
PL-1; Wilsonart, Burnished Chestnut 4796-60

Company Co-op

Countertop on toilet rooms
PL-1; Wilsonart, Burnished Chestnut 4796-60

- c. Signage Message Color (excluding handicapped signage):
- d. Signage Background Color (excluding handicapped signage):
- e. Lockers:
M201; Penco Black
- g. Corner Guards:
M301; CIS Acrovyn, Cappuccino #479
M302; Kenmark, Clear Arcylic
- h. Wall Switch Handles and Standard Receptacle Bodies:
Ivory
- i. Electrical Device Cover Plates and Panels:
Ivory
- j. Casework:
Soldier Comm. Building
CQ Counter
AM#1Countertop; **REPLACE** Avanza, Ranzano Nuovo 1605
WITH SILESTONE, COFFE BROWN 1302
Body; Chemetal, #924 Bronze Stainless Steel
Reveal; Black
Base; Johnsonite, Tigltlock, Black Pearl B101

*NOTE: SEE ARCH DRWG A-A104 DETAIL 11

Barracks;
Kitchen

Cabinet fronts; Natural Stain
 Counter-top; PL-1 Wilsonart Burnished Chestnut 4796-60

Bath

Cabinet fronts; Natural Stain
 Counter-top; Wilsonart/Gilbralter, Earthstone, Flagstone 9038-EA

Company Co-ops

Counter-top in Toilet Room
 PL-1 Wilsonart Burnished Chestnut 4796-60

2.2.11 ROOM COLOR AND FINISH SCHEDULE

SOLDIER COMMUNITY BUILDING

AREA;	CQ AREA A101						
	BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
	B201	F401	W101	W101	W701	W101	C101
AREA;	CORRIDOR A102						
	BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
	B201	F401	W201	W201	-	W201	C101
AREA;	MEETING ROOM A103						
	BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
	B101	F101	W202	W202	W202	W202	C101
AREA;	MEN A104						
	BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
	-	F402	W401	W401	W401	W401	C201
AREA;	WOMEN A105						
	BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
	-	F402	W401	W401	W401	W401	C201
AREA;	JANITOR A106						
	BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
	-	F301	W301	W301	W301	W301	C201
AREA;	ELEC A107						
	BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
	B102	CONC	W102	W102	W102	W102	C201
							Exposed
AREA;	COMM A108						
	BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
	B102	F201	W102	W102	W102	W102	C201
AREA;	MUD AREA A109						
	BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
	-	F501	W401	W401	W401	W401	C101
AREA;	LAUNDRY A110						
	BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
	-	FG501	W702	W302	W302	W302	C101
			W302				
AREA;	MAIL ROOM A111						
	BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING

B102 F201 W102 W102 W102 W102 C201

AREA; MECHANICAL A112

BASE FLOOR A WALL B WALL C WALL D WALL CEILING
 - CONC W102 W102 W102 W102 C201

AREA; LAUNDRY SERVICE AREA

BASE FLOOR A WALL B WALL C WALL D WALL CEILING
 - - W102 W102 W102 W102 C201

BARRACKS ALL FLOORS

AREA; LIVINGSLEEPING

BASE FLOOR A WALL B WALL C WALL D WALL CEILING
 B103 F701 W103 W103 W103 W103 C201

AREA; CLOSET

BASE FLOOR A WALL B WALL C WALL D WALL CEILING
 B103 F701 W103 W103 W103 W103 C201

AREA; SERVING AREA

BASE FLOOR A WALL B WALL C WALL D WALL CEILING
 B103 F701 W103 W103 W103 W103 C201
 W203

AREA; BATH AREA

BASE FLOOR A WALL B WALL C WALL D WALL CEILING
 - F403 W401 W401 W401 W401 C201

AREA; COMM

BASE FLOOR A WALL B WALL C WALL D WALL CEILING
 - CONC W103 W103 W103 W103 C201

AREA; ELEC

BASE FLOOR A WALL B WALL C WALL D WALL CEILING
 - CONC W103 W103 W103 W103 C201

COMPANY OPERATIONS BUILDING

AREA; VESTIBULE C0101;C0201;C0301;C0401;C0401;C0501;C0601;C0701;C0801;
 C0901;C1001

BASE FLOOR A WALL B WALL C WALL D WALL CEILING
 B201 F401 - W101 - W102 C101

AREA; WAITING C0102;C0202;C0302;C0402;C0402;C0502;C0602;C0702;C0802;
 C0902;C1002

BASE FLOOR A WALL B WALL C WALL D WALL CEILING
 B201 F401 - W101 W101 W101 C101

AREA; ADMIN C0101;C0203;C0303;C0403;C0403;C0503;C0603;C0703;C0803;
 C0903;C1003

BASE FLOOR A WALL B WALL C WALL D WALL CEILING
 B101 F101 W101 W101 W101 W101 C101

AREA; TRAINING OFFICE

C0104;C0204;C0304;C0404;C0404;C0504;C0604;C0704;C0804;C0904;C1004
 BASE FLOOR A WALL B WALL C WALL D WALL CEILING

B101 F101 W101 W101 W101 W101 C101

AREA; FIRST SERGEANT

C0105;C0205;C0305;C0405;C0405;C0505;C0605;C0705;C0805;C0905;C1005

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B101	F101	W101	W101	W101	W101	C101

AREA; EXEC.OFFICER C0106;C0206;C0306;C0406;C0406;C0506;C0606;C0706;C0806;
C0906;C1006

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B101	F101	W101	W101	W101	W101	C101

AREA; COMMANDER C0107;C0207;C0307;C0407;C0407;C0507;C0607;C0707;C0807;
C0907;C1007

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B101	F101	W101	W101	W101	W101	C101

AREA; STORAGE C0108;C0208;C0308;C0408;C0408;C0508;C0608;C0708;C0808;
C0908;C1008

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B101	F101	W102	W102	W102	W102	C201

AREA; PLATOON OPEN OFFICE

C0109;C0209;C0309;C0409;C0409;C0509;C0609;C0709;C0809;C0909;C1009

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B101	F101	W101	W101	W101	W101	C101

AREA; PLATOON OFFICE C0110;C0210;C0310;C0410;C0410;C0510;C0610;C0710;C0810;
C0901;C1001

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B101	F101	W101	W101	W101	W101	C101

AREA; PLATOON OFFICE C0111;C0211;C0311;C0411;C0411;C0511;C0611;0711;C0811;
C0911;C1011

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B101	F101	W101	W101	W101	W101	C101

AREA; ELEC C0112;C0212;C0312;C0412;C0412;C0512;C0612;C0712;C0812;
C0912;C1012

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B102	F201	W102	W102	W102	W102	C201

AREA; JANITOR C0113;C0213;C0313;C0413;C0413;C0513;C0613;C0713;C0813;
C0913;C1013

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	F301	W301	W301	W301	W301	C201

AREA; TLT/SHO C0114;C0214;C0314;C0414;C0414;C0514;C0614;C0714;C0814;
C0914;C1014

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	F401	W401	W401	W401	W401	C201

*NOTE; SEE PARAGRAPH 2.2.6 for Shower Area Tile

AREA; TLT/SHO C0115;C0215;C0315;C0415;C0415;C0515;C0615;C0715;C0815;
C0915;C1015

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	F401	W401	W401	W401	W401	C201

*NOTE; SEE PARAGRAPH 2.2.6 for Shower Area Tile

AREA; MECH C0116;C0216;C0316;C0416;C0416;C0516;C0616;C0716;C0816;
C0916;C1016

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	CONC	W102	W102	W102	W102	C201 EXPOSED

AREA; CORRIDOR C0117;C0217;C0317;C0417;C0417;C0517;C0617;C0717;C0817;
C0917;C1017

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B201	F401	W101	-	W101	W101	C101

AREA; CORRIDOR C0118;C0218;C0318;C0418;C0418;C0518;C0618;C0718;C0818;
C0918;C1018

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B201	F401	W101	W101	-	W101	C101

AREA; STORAGE C0119;C0219;C0319;C0419;C0419;C0519;C0619;C0719;C0819;
C0919;C1019

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B101	F102	W102	W102	W102	W102	C201

AREA; CONFERENCE C0120;C0220;C0320;C0420;C0420;C0520;C0620;C0720;C0820;
C0920;C1020

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B101	F101	W202	W202	W202	W202	C201

AREA; STORAGE C0122;C0222;C0322;C0422;C0422;C0522;C0622;C0722;C0822;
C0922;C1022

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
B101	F101	W102	W102	W102	W102	C201

AREA; VESTIBULE C0123;C0223;C0323;C0423;C0423;C0523;C0623;C0723;C0823;
C0923;C1023

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	F401	W401	W401	W401	W401	C201

AREA; WOMENS C0124;C0224;C0324;C0424;C0424;C0524;C0624;C0724;C0824;
C0924;C1024

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	F401	W401	W401	W401	W401	C201

*NOTE; SEE PARAGRAPH 2.2.6 for Shower Area Tile

AREA; VESTIBULE C0125;C0225;C0325;C0425;C0425;C0525;C0625;C0725;C0825;
C0925;C1025

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	F401	W401	W401	W401	W401	C201

AREA; LOCKERS C0126;C0226;C0326;C0426;C0426;C0526;C0626;C0726;C0826;
C0926;C1026

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	F401	W401	W401	W401	W401	C201

AREA; MENS C0127;C0227;C0327;C0427;C0427;C0527;C0627;C0727;C0827;
C0927;C1027

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	F401	W401	W401	W401	W401	C201

*NOTE; SEE PARAGRAPH 2.2.6 for Shower Area Tile

AREA; COMM C0128;C0228;C0328;C0428;C0428;C0528;C0628;C0728;C0828;
C0928;C1028

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	CONC	W102	W102	W102	W102	C201

AREA; COMMO STORAGE C0129;C0229;C0329;C0429;C0429;C0529;C0629;C0729;C0829;
C0929;C1029

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	CONC	WIRE PARTITION	W102	W102	WIRE PARTITION	C201 EXPOSED

AREA; NBC STORAGE C0130;C0230;C0330;C0430;C0430;C0530;C06030;C0730;C0830;
C0930;C1030

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	CONC	W102	W102	WIRE	WIRE	C201 PARTITION PARTITION EXPOSED

AREA; TA-50 GEAR C0131;C0231;C0331;C0431;C0431;C0531;C0631;C0731;C0831;
C0931;C1031

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	CONC	W102	W102	W102	WIRE	C201 PARTITION EXPOSED

AREA; EQUIP MAINT. C0132;C0232;C0332;C0432;C0432;C0532;C0632;C0732;C0832
C0932;C1032

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	CONC	W102	W102	W102	W102	C201 WIRE EXPOSED PARTITION PARTITION

AREA; GENERAL STORAGE
C0133;C0233;C0333;C0433;C0433;C0533;C0633;C0733;C0833;C0933;C1033

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	CONC	WIRE	WIRE	W102	W102	C201 PARTITION PARTITION EXPOSED

AREA; ARMS VAULT C0134;C0234;C0334;C0434;C0434;C0534;C0634;C0734;C0834;
C0934;C1034

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	CONC	W102	W102	W102	W102	CONCRETE SLAB

AREA; UNIT STORAGE C0135;C0235;C03355;C0435;C04355;C0535;C0635;C0735;C0835;
C0935;C1035

BASE	FLOOR	A WALL	B WALL	C WALL	D WALL	CEILING
-	CONC	W102	WIRE	W102	W102	C201 PARTITION EXPOSED

0

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 13815

AUTOMATED METER READING SYSTEM

09/2002

Amendment No. 0001

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- | | |
|-------------|--|
| ANSI B109.2 | (1992) Diaphragm Type Gas Displacement Meters(500 Cubic Feet per Hour Capacity and Over) |
| ANSI C12.4 | (1984; R 1996) Mechanical Demand Registers |
| ANSI C12.10 | (1987) Electromechanical Watthour Meters |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- | | |
|------------|---|
| ASME B31.8 | (1995) Gas Transmission and Distribution Piping Systems |
|------------|---|

AMERICAN WATER WORKS ASSOCIATION (AWWA)

- | | |
|---------------------|---|
| AWWA ANSI/AWWA C700 | (1995) Cold-Water Meters - Displacement Type, Bronze Main Case |
| AWWA ANSI/AWWA C701 | (1988) Cold-Water Meters - Turbine Type, for Customer Service |
| AWWA ANSI/AWWA C702 | (1992) Cold-Water Meters - Compound Type |
| AWWA ANSI/AWWA C703 | (1996) Cold-Water Meters - Fire Service Type |
| AWWA ANSI/AWWA C704 | (1992) Propeller-Type Meters Waterworks Applications |
| AWWA ANSI/AWWA C706 | (1996) Direct-Reading, Remote-Registration Systems for Cold-Water Meters |
| AWWA ANSI/AWWA C707 | (1982; R 1992) Encoder-Type Remote-Registration Systems for Cold-Water Meters |

1.2 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:

SD-02 Shop Drawings

Meter Interface Unit (MIU);
Water Meters;
Gas Meters;
Electric Metering, kWh and Demand;

The manufacturer's recommendations for each material or procedure to be utilized.

SD-08 Manufacturer's Instructions

Manufacturer's Recommendations;

The manufacturer's installation recommendations for each material or procedure to be utilized.

PART 2 PRODUCTS

2.1 GENERAL

Meter reading at Fort Hood is performed via telephone lines to a central computer. Specified meters and electronic interface units provided under this Contract shall be compatible with the existing Teldata Inc. system. The drawings shall depict the location of each meter. Contractor shall supply all necessary labor and materials to provide a fully functional system. Item submitted shall have been a standard manufactured product for at least one year.

2.2 METER INTERFACE UNIT (MIU)

2.2.1 General

A dial in-bound type Meter Interface Unit (MIU) shall be installed where shown or directed, to record pulses or encoded signals from each electric, gas, and water meter. The MIU shall be factory mounted in a NEMA type 1 or NEMA type 3R for indoor or outdoor installation, respectively. The MIU shall be a Teldata Inc., Model [Am#0001 TDS-4M] with appropriate number of PB-01 boards. Where length of conductor from the meter to MIU exceeds 152 meters, additional MIU's shall be provided as necessary.

2.2.2 MIU Connections

The data cable shall be routed from the each meter to the MIU through appropriate sized conduit. Approximately 305 mm to 610 mm of cable shall be provided at both ends for final connection. The final connection is in accordance with PART 3 Paragraph TESTING.

2.2.3 Meter Retrofit Kits

Pointer type electric and gas meters may be retrofitted with a RioTronics retrofit kit capable of providing the required pulse output to the Meter

Interface Unit. Retrofit kit shall generate 10 pulses per revolution of the associated pointer (Normally the least significant dial). Gas meters of sizes 750 class and larger will require an MC816 index cover.

NOTE: Possible source of retrofit kit is: Riotronics Corps, 6841 Yosemite, Unit 100, Englewood CO, 80112, (303) 773-2600. This source is not intended to preclude the use of other compatible retrofit kit manufacturers and suppliers.

2.3 WATER METERS

Meters 50 mm (2 inches) and smaller shall be positive displacement type conforming to AWWA ANSI/AWWA C700. Meters 65 mm (2-1/2 inches) and larger shall be turbine type conforming to AWWA ANSI/AWWA C701. One manufacturer shall supply meters of each of the various types furnished and installed. Registers shall be an encoder type remote register designed in accordance with AWWA ANSI/AWWA C707. The communications register shall be enclosed in a waterproof glass lens with potted terminals designed. Meters shall include a 1220 mm (4-foot) 3-conductor, 22 AWG (minimum) shielded output cable. Registers shall be compatible with the Meter Interface Unit (MIU).

2.3.1 Displacement Type

Displacement type meters shall conform to AWWA ANSI/AWWA C700. Registers shall be straight-reading and shall read in U.S. gallons. Meters in sizes 13 mm to 25 mm (1/2 through 1 inch) shall be frost-protection design. Connections shall be suitable to the type of pipe and conditions encountered.

2.3.2 Turbine Type

Turbine type meters shall conform to AWWA ANSI/AWWA C701 Class II and shall be furnished with strainers. The main casing shall be bronze with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Meters shall comply with the accuracy and capacity requirements of AWWA ANSI/AWWA C701.

2.4 GAS METERS

Meter shall conform to ANSI B109.2. Meter shall be pipe or pedestal mounted and be provided with a strainer immediately upstream. Meters shall be provided with over-pressure protection as specified in ASME B31.8. Meters shall be suitable for accurately measuring and handling gas at pressures, temperatures, and flow rates indicated. Meters shall have an encoded register, when available for selected meter type. Encoded registers shall include an electronics communication package to deliver a compatible encoded signal via a 3-conductor, 22-AWG AMRS output cable to the Meter Interface Unit. The communication register shall be enclosed in a waterproof glass lens with potted terminals. Otherwise, a pulse switch initiator capable of operating up to speeds of 500 pulses per minute with no false pulses shall be used and shall require no field adjustments. Meter registers shall be the clock pointer type. Initiators shall provide the maximum number of pulses up to 500 per minute that is obtainable from the manufacturer. It shall provide not less than one pulse per 2.8 cubic meters (100 cubic feet) of gas. When required, a non-pulse type meter may be used when retrofitted with a meter retrofit kit as described in PART 2 Paragraph "Meter Retrofit Kits."

2.5 ELECTRIC METERING, KWH AND DEMAND

Electric meters shall be as specified in Section 16415A ELECTRICAL WORK, INTERIOR or Section 16375A ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

2.6 WIRE AND CABLE

Wiring methods shall conform to SECTION 16415A ELECTRICAL WORK, INTERIOR. Wiring installed underground shall be in accordance with wiring methods specified by SECTION 16375A ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

2.6.1 Meter Interface Unit to Meter Register Wiring

Wiring shall be No. 22 AWG minimum solid copper with 600-volt insulation, twisted and shield, 3-wire to match MIU hardware. The color code shall be red, green and black. Multiple conductor wiring shall have an outer jacket of PVC. Connections of leads from registers shall be made in waterproof type terminal boxes, when installed below grade. Connections made above grade and exterior to the building shall be weatherproof type.

2.6.2 Meter Interface Unit to Telephone Block

Wiring shall be No. 22 AWG minimum solid copper with 600-volt insulation, twisted and shield, 2-wire to match MIU hardware. The color code shall be red and black or red and green. The phone cable shall be routed from the MIU to the nearest telephone terminal block. Where possible, a dedicated phone line shall be designated. Connections of leads from registers shall be made in waterproof type terminal boxes, when installed below grade. Connections made above grade and exterior to the building shall be weatherproof type.

PART 3 EXECUTION

3.1 METER INTERFACE UNIT

Meter Interface Units shall be located where indicated with mounting and connections made in accordance with manufacturer recommendations.

3.2 WATER METERS

3.2.1 Location of Meters

Meters shall be installed at the locations shown on the drawings. Meters shall be installed in accordance with manufacturer's recommendation or as shown on plans. Permanent water meters of sizes 65 mm (2-1/2-inch) and larger shall be installed with provisions for isolation and removal for calibration and maintenance.

3.3 GAS METERS

3.3.1 Connections To Existing Lines

Connections between new work and existing gas lines, where required, shall be made in accordance with ASME B31.8, using proper fittings to suit the actual conditions. When connections are made by tapping into a gas main, the connecting fittings shall be the same size as the pipe being connected.

Gas meters and associated hardware shall be installed in accordance to manufacturer's recommendations or as shown on drawings.

3.4 ELECTRICAL METERS

Wiring methods shall conform to Section 16415A ELECTRICAL WORK, INTERIOR. Wiring installed underground shall be in accordance with wiring methods specified by Section 16375A ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.5 TESTING

The Contractor shall insure that all wiring is continuous and properly labeled from meter to MIU prior to making any final connections. Upon completion of continuity testing and labeling, the Contractor shall provide a 5 days notice to the Contracting Officer representative to coordinate with Fort Hood personnel, who will verify readings and registers, make final wiring connections and program the MIU(s). Fort Hood personnel and the Contractor shall verify meter readings sent to the central computer to insure the system is responding and data sent is consistent with the meter registers.

-- End of Section --

SECTION 16311A

MAIN ELECTRIC SWITCHING STATION AND SUBSTATION
05/01
Amendment No. 0001

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(1995) Code for Electricity Metering
ANSI C12.4	(1984; R 1996) Mechanical Demand Registers
ANSI C12.10	(1997) Electromechanical Watthour Meters
ANSI C12.11	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)
ANSI C29.1	(1988; R 1996) Electrical Power Insulators - Test Methods
ANSI C29.2	(1992) Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type
ANSI C29.9	(1983; R 1996) Wet-Process Porcelain Insulators - Apparatus, Post-Type
ANSI C37.06	(1997) AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis - Preferred Ratings and Related Required Capabilities for Switchgear
ANSI C37.16	(2000) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
ANSI C37.32	(1996) High-Voltage Air Switches, Bus Supports, and Switch Accessories - Schedules of Preferred Ratings, Manufacturing Specifications, and Application Guide
ANSI C37.46	(1981; R 1992) Power Fuses and Fuse Disconnecting Switches
ANSI C37.121	(1989; R 1995) Switchgear, Unit Substations Requirement

- ANSI C39.1 (1981; R 1992) Requirements for Electrical Analog Indicating Instruments
- ANSI C57.12.10 (1988) Safety Requirements for Transformers 230 kV and Below 833/958 Through 8333/10417 kVA, Single-Phase, and 750/862 Through 60 000/80 000/100 000 kVA, Three-Phase Without Load Tap Charging; and 3750/4687 Through 60 000/80 000/100 000 kVA With Load Tap Charging
- ANSI C57.12.20 (1997) Overhead Type Distribution Transformers, 500 KVA and Smaller: High Voltage 34 500 Volts and Below: Low Voltage, 7970/13 800 Y Volts and Below
- ANSI C93.3 (1995) Requirements for Power-Line Carrier Line Traps
- ANSI C135.30 (1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM A 36/A 36M (2000) Carbon Structural Steel
- ASTM A 123/A 123M (2000) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A 153/A 153M (2000) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM A 572/A 572M (2000) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
- ASTM A 575 (1996) Steel Bars, Carbon, Merchant Quality, M-Grades
- ASTM A 576 (1990b; R 1995e1) Steel Bars, Carbon, Hot-Wrought, Special Quality
- ASTM A 633/A 633M (2000) Normalized High-Strength Low-Alloy Structural Steel Plates
- ASTM B 8 (1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- ASTM B 117 (1997) Operating Salt Spray (Fog) Apparatus
- ASTM B 188 (1996) Seamless Copper Bus Pipe and Tube
- ASTM B 231/B 231M (1999) Concentric-Lay-Stranded Aluminum 1350 Conductors
- ASTM B 317 (2000) Aluminum-Alloy Extruded Bar, Rod, Tube, Pipe, and Structural Profiles for Electrical Purposes (Bus Conductor)
- ASTM D 923 (1997) Sampling Electrical Insulating

Liquids

- ASTM D 1654 (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
- ASTM D 2472 (2000) Sulfur Hexafluoride
- ASTM D 4059 (1996) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography

ASME INTERNATIONAL (ASME)

- ASME B31.3 (1999) Process Piping
- ASME BPVC SEC IX (1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WELDING SOCIETY (AWS)

- AWS D1.1 (2000) Structural Welding Code - Steel

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE C2 (2002) National Electrical Safety Code
- IEEE C37.1 (1994) IEEE Standard Definition, Specification, and Analysis of Systems Used for Supervisory Control, Data Acquisition, and Automatic Control
- IEEE C37.2 (1996) Electrical Power System Device Function Numbers and Contact Designations
- IEEE C37.04 (1999; C37.04g; C37.04i) Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
- IEEE C37.081 (1981; C37.081a; R 1988) Guide for Synthetic Fault Testing of AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
- IEEE C37.09 (1999) Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis
- IEEE C37.13 (1990; R 1995) Low-Voltage AC Power Circuit Breakers Used in Enclosures
- IEEE C37.20.2 (1993; C37.20.2b) Metal-Clad and Station-Type Cubicle Switchgear
- IEEE C37.23 (1987; R 1991) Guide for Metal-Enclosed Bus and Calculating Losses in Isolated-Phase Bus

IEEE C37.30	(1997)Requirements for High-Voltage Air Switches
IEEE C37.34	(1994) Test Code for High-Voltage Air Switches
IEEE C37.41	(1994; C37.41c) Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories
IEEE C37.90	(1989; R 1994) Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C37.90.1	(1989; R 1994) IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems
IEEE C37.98	(1987; R 1991) Seismic Testing of Relays
IEEE C57.12.00	(1993) Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.12.01	(1998) Standard General Requirements for Dry-Type Distribution and Power Transformers Including Solid-Cast and/or Resin-Encapsulated Windings
IEEE C57.12.80	(1996) Terminology for Power and Distribution Transformers
IEEE C57.12.90	(1999) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers
IEEE C57.13	(1993) Instrument Transformers
IEEE C57.15	(1986; R 1992) Requirements, Terminology, and Test Code for Step-Voltage and Induction-Voltage Regulators
IEEE C57.19.00	(1991; R 1997) IEEE Standard General Requirements and Test Procedures for Outdoor Power Apparatus Bushings
IEEE C57.19.01	(1991; R 1997) Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings
IEEE C57.93	(1995) Guide for Installation of Liquid Immersed Power Transformers
IEEE C57.98	(1993) Guide for Transformer Impulse Tests
IEEE C62.1	(1989; R 1994) Surge Arresters for AC Power Circuits

IEEE C62.2	(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems
IEEE C62.11	(1999) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits
IEEE Std 18	(2002) IEEE Standard for Shunt Power Capacitors
IEEE Std 32	(1972; R 1991) Requirements, Terminology, and Test Procedure for Neutral Grounding Devices
IEEE Std 80	(1997) IEEE Guide for Safety in AC Substation Grounding
IEEE Std 81	(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
IEEE Std 100	(1997) IEEE Standard Dictionary of Electrical and Electronics Terms
IEEE Std 242	(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
IEEE Std 399	(1997) Recommended Practice for Industrial and Commercial Power Systems Analysis
IEEE Std 484	(1996) Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications
IEEE Std 485	(1997) Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations
IEEE Std 525	(1992) IEEE Guide for the Design and Installation of Cable Systems in Substations
[AM#0001 <u>IEEE std 691</u>	<u>(2001) IEEE Guide for Transmission Structure Foundation Design]</u>

INSTRUMENT SOCIETY OF AMERICA (ISA)

ISA S18.1	(1979; R 1992) Annunciator Sequences and Specifications
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
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NEMA AB 1	(1993) Molded Case Circuit Breakers and Molded Case Switches
NEMA LA 1	(1992) Surge Arresters
NEMA PB 1	(1995) Panelboards
NEMA SG 2	(1993) High Voltage Fuses
NEMA SG 3	(1995) Power Switching Equipment
NEMA SG 5	(1995) Power Switchgear Assemblies
NEMA SG 6	(1995) Power Switching Equipment
NEMA WD 1	(1999) General Requirements for Wiring Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2002) National Electrical Code
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UNDERWRITERS LABORATORIES (UL)

UL 6	(1997) Rigid Metal Conduit
UL 50	(1995; Rev thru Nov 1999) Enclosures for Electrical Equipment
UL 67	(1993; Rev thru Oct 1999) Panelboards
UL 467	(1993; Rev thru Apr 1999) Grounding and Bonding Equipment
UL 486B	(1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors
UL 489	(1996; Rev thru Dec 1998) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 1236	(1994; Rev thru Mar 1999) Battery Chargers for Charging Engine-Starter Batteries

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

Terminology used in this specification is as defined in IEEE Std 100.

1.2.2 System Description

The system shall be configured as specified, and shall include structures, incoming and outgoing lines, transformers, regulators, fuses, circuit breakers, switches, switchgear, and appurtenances to provide a fully functional system.

1.2.3 Incoming and Outgoing Circuit Compliance

Aerial line circuits shall comply with the requirements of Section 16370 ELECTRICAL TRANSMISSION AND DISTRIBUTION SYSTEM, AERIAL.

1.3 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:

SD-02 Shop Drawings

General Installation Requirements; G, ED
Detail Drawings; G, ED

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams, and other information necessary to define the installation shall be submitted. Detail drawings shall show the ratings of items and systems and how the components of an item and system are assembled, function together, and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall show physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. Optional items shall be clearly identified as included or excluded. Detail drawings shall as a minimum include:

- a. Incoming line and station bus structures and integral equipment.
- b. Transformers.
- c. Switching and Protective Equipment.
- d. Battery system including calculations for the battery and charger.
- e. Station single line electrical diagrams including primary, metering, sensing and relaying, control wiring, and control logic.
- [Am#0001 f. Relay and Control Panels including detailed parts list.]

Structural drawings shall be prepared to show the structural or physical features of major items of station equipment and components of equipment or equipment assemblies and structures,

including foundations or other types of supports for equipment and conductors. Those drawings shall include accurately scaled or dimensioned outline and arrangement or layout drawings to show the physical size of station equipment and component parts of the equipment and the relative arrangement of components and any physical connection of related components. Weights of equipment and components of equipment assemblies shall be provided when required to verify the adequacy of design and proposed construction of foundations or other types of supports. Dynamic forces shall be stated for switching devices when such forces must be considered in the design of support structures. The appropriate detail drawings shall show the provisions for leveling, anchoring, and connecting all items of station equipment during installation, and shall include any recommendations made by the manufacturer of the equipment.

Electrical drawings shall include single-line and three-line diagrams of the station and station equipment, schematics or elementary diagrams of each electrical system; internal wiring and external connection diagrams of each electrical device when published by the manufacturer; wiring diagrams of cabinets, panels, units, or other separate mountings; interconnection diagrams that show the wiring between separate components of assemblies; external connection diagrams that show the termination of wiring routed between separate items of station equipment; internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with the detail drawings. Approved departures shall be made at no additional cost to the Government.

As-Built Drawings; G, RE

The as-built drawings shall be a record of the construction as installed. The drawings shall include all the information shown on the contract drawings as well as all deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full sized set of prints marked to reflect all deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

[AM#0001 Support Structure Installation; G, ED

Detail and erection drawings, before proceeding with any fabrication. The drawings shall be complete with details of steel, pipe, and concrete work and with details of the assembling of items required for the complete installation. Standard welding symbols as recommended by the American Welding Society shall be used. Details of welded joints referenced on the drawings shall be included.]

SD-03 Product Data

Support Structures; G, ED

Manufacturer's design analysis and calculations for structures, foundations, anchor bolts, and supports differing from those indicated in the contract drawings, and for prefabricated structures. Calculations shall be made by a registered professional engineer with demonstrated experience in substation structural design in the last three years. The manufacturer shall provide a list of projects complete with points of contact, addresses and telephone numbers. [AM#0001 Computations shall include design parameters, assumptions, and reference material, such as tables, charts, and other empirical data. Design text references shall be stated for formulas. Material specification data shall be computed from available standard data. All plans and computations shall bear the seal of a Registered Professional Engineer.]

Battery; G, ED

Calculations for the battery and associated charger indicating the basis used in defining loads, selecting cell types, and determining the battery ampere-hour capacity and physical size. Calculations shall be provided to determine capacity for the battery charger and be similar to those shown in the Appendix to IEEE Std 485, including explanatory data. Calculations for the battery-charger shall demonstrate that the output voltage and current provided are adequate to comply with the preceding requirements.

Nameplates; [____],

Submit data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material and Equipment; ,

A complete itemized listing of equipment and materials proposed for incorporation into the work shall be submitted. Each entry shall include an item number, the quantity of items proposed, and the name of the manufacturer of each such item.

General Installation Requirements; [____], [____]

As a minimum, the Contractor shall submit installation procedures for station buses and insulators, station structures,

transformers, switchgear, battery system, voltage regulators and grounding resistors.

Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

Onsite Tests; G, [_____]

A detailed description of the Contractor's proposed procedures for on-site tests.

SD-06 Test Reports

Factory Tests; G, ED

copies of the information described below in 215.9 x 279.4 mm (8 1/2 x 11 inch) binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of all equipment used, with calibration certifications.
- b. A copy of all measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The condition specified for the test.
- f. The test results, signed and dated.
- g. A description of all adjustments made.

Field Testing; G, RE

A detailed description of the Contractor's proposed procedures for on-site tests submitted 30 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Field Test Reports; G, RE

Six copies of the information described below in 215.9 x 279.4 mm (8 1/2 x 11 inch) binders having a minimum of 5 rings from which material may readily be removed and replaced, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

- a. A list of all equipment used, with calibration certifications.
- b. A copy of all measurements taken.

- c. The dates of testing.
- d. The equipment and values verified.
- e. The condition specified for the test.
- f. The test results, signed and dated.
- g. A description of all adjustments made.
- h. Final position of controls, and device settings.

SD-07 Certificates

Material and Equipment; G, RE

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories, Inc., (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided under this section of the specifications conform to such requirements. The label of, or listing by, UL will be acceptable evidence that the items conform thereto. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable evidence that the item conforms thereto. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable evidence that the item conforms thereto. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G, RE

Six copies of operation and maintenance manuals, within calendar days following the completion of tests and including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information

and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare-parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

Three additional copies of the instructions manual within 30 days following the approval of the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the Contracting Officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

Products shall conform to the following requirements. Items of the same classification shall be identical including equipment, assemblies, parts, and components. Products for aerial construction shall conform to IEEE C2 for medium loading districts, Grade B construction.

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.2 NAMEPLATES

2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. As a minimum, nameplates shall be provided for transformers, regulators, circuit breakers, capacitors, meters, switches, switchgear, and grounding resistors.

2.2.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with Nameplate C information in accordance with IEEE C57.12.00. Nameplates shall indicate the number of gallons and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is

non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 50 ppm PCB content in accordance with paragraph MISCELLANEOUS Liquid Dielectrics. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 50 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

2.3 CORROSION PROTECTION

2.3.1 Aluminum Materials

Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486B shall be used.

2.3.2 Ferrous Metal Materials

2.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

2.3.2.2 Equipment

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaires not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1.6 mm (1/16 inch) from the test mark. The scribed test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section 09900 PAINTING, GENERAL.

2.4 STATION ARRANGEMENT

The main electric supply substation shall be of the substation transformer type with an open-type bus-and-switch arrangement. The 138kV switching station shall be of the open-type bus-and-switch arrangement.

2.4.1 Support Structures

[AM#0001 Medium voltage support structures and foundations shall be as shown on the drawings. Structures not specifically sized and detailed on the drawings shall be designed by the Contractor and approved by the Contracting Officer to support incoming line conductors, switches, instrument transformers, air terminals and aerial buses. General configurations are indicated. Exact dimensions and arrangements may be varied, dependent upon site limitations, to permit use of a manufacturer's

standard equipment and structures. Structures shall be designed to withstand the loads specified in IEEE C2 for medium loading zone for Grade B requirements multiplied by the appropriate overload capacity factors. Calculations shall be submitted in accordance with the detail drawings portion of paragraph SUBMITTALS. Steel structural items shall conform to Section 05120 STRUCTURAL STEEL. Structures shall utilize round or rectangular tubular steel construction or equivalent H/I-beam support elements. Structural steel and miscellaneous items shall comply with ASTM A 36/A 36M, ASTM A 572/A 572M, ASTM A 575, ASTM A 576or ASTM A 633/A 633M, or equivalent aluminum.]

2.4.1.1 Pre-fabricated Structure Design

Incoming Structures shall be designed for a maximum tension of 46.5 kN (10,450 pounds) per conductor. High voltage bus and equipment support structures shall be designed for the equipment indicated. Overhead ground or static wires shall be counted as conductors in determining strength requirements. Detail drawings shall show markings of units for placement, location and sizes of attachments, and complete data on fabrications.

2.4.1.2 Structure Finish

Aluminum structures shall have a uniform satin finish and shall not be painted. Steel structures shall be hot-dip galvanized in accordance with ASTM A 123/A 123M after drilling is completed and shall not be painted.

2.4.1.3 Structure Foundation Design

Structure foundation design shall be as indicated. Structure foundations not specifically sized and detailed on the drawings shall be designed by the Contractor and approved by the Contracting Officer. General configurations are indicated. Exact dimensions and arrangements may be varied, dependent upon site limitations, to permit use of a manufacturer's standard equipment and structures. If the manufacturer's standard structures differ in dimensions from those shown, foundation design shall be modified to suit the structures provided, at no additional cost to the Government. The design and fabrication of the foundations for the structures shall be in accordance with the applicable requirements of IEEE C2, IEEE Std 691, ACI 318, ASCE 52/72, except as modified herein. Foundations shall be constructed of reinforced concrete in conformance with the applicable requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE, except as shown or specified herein. Factor of safety shall be as required in the design standards and as approved by the Contracting Officer. Maximum earth-bearing pressure shall be calculated at 96 kPa for spread footings or 383 kPa for piers. Design calculations for the foundations shall be approved before installation of the foundations are permitted. Calculations shall be submitted in accordance with the design data portion of paragraph entitled "SUBMITTALS."]

2.4.2 Conductors

Conductors and busses shall be of the type and sizes as indicated, and shall comply with IEEE Std 525. Span lengths shall be based on a limiting deflection of 1/150 for spans having two supports and 1/200 for spans having three supports, under maximum wind, ice, and short-circuit loadings, including suitable allowances for any taps. Where required, larger or stronger bus shall be installed to maintain specified deflections for the indicated span lengths. Other bus shapes for electrical conductors may be used if detail drawing submittals indicate equivalent ampacity and

strength. Short connections, consisting of bare stranded conductors of equivalent bus ampacity, may be used between incoming line conductors and buses or between buses and equipment. Copper flexible braid or aluminum strap expansion couplers, as required to match the bus material, shall be installed in bus runs where required to allow for expansion and contraction, and at all connections to transformer bushings.

2.4.2.1 Suspension Insulators

Suspension insulators shall be provided for dead-end incoming and outgoing line conductors. Suspension insulator strings and string supports shall provide a mechanical strength exceeding the ultimate strength of each dead-end conductor. Suspension insulators shall comply with the requirements of Section 16370

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2.4.2.2 Apparatus Post Insulators

Apparatus post insulators shall be provided to support conductors, and their mechanical strength shall exceed the ultimate strength of the conductor supported and, where necessary, high-strength or ultra high-strength insulators shall be provided. Minimum ratings of apparatus post insulators shall be not less than ANSI C29.9, Technical Reference Number 287 for high voltage and 205 for medium voltage.

2.5 INCOMING SWITCHING/CIRCUIT INTERRUPTING EQUIPMENT

Incoming line switching equipment shall be of the outdoor weatherproof type. Operating characteristics and ratings of incoming line switching equipment shall be as indicated.

2.5.1 Circuit Interrupters for Transformer Protection

Interrupters shall comply with ANSI C37.32 and shall be single-gap SF6 puffer-type providing three-phase tripping by electrically linked pole-units. Interrupters shall be equipped with a self-powered overcurrent protection system with three microprocessor-based, self-powered overcurrent relays and a trip-energy supply, all housed in a weatherproof control cabinet. Relay settings shall be coordinated with the transformer provided. A manual trip device, which provides the energy to trip all three pole-units if the line is de-energized, shall be included.

2.5.1.1 Ratings

Interrupter ratings at 60 Hz shall be as follows:

Nominal voltage.....	138 kV
Rated maximum voltage.....	145 kV
Maximum symmetrical interrupting capacity.....	31.5 kA
Interrupting Time.....	3 cycles
Total Fault Clearing Time.....	5 cycles
Rated continuous current	420 A
BIL (Impulse Level).....	650

2.5.2 Circuit Breakers

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Circuit breakers shall comply with IEEE C37.04 and ANSI C37.06. Circuit breakers shall be of the sulfur hexafluoride (SF6) type having electrically charged, stored-energy mechanisms which are mechanically and electrically trip free. A means for manual charging of each trip mechanism shall be provided. Circuit breakers of the same ampere rating shall be interchangeable, both mechanically and electrically. In addition to any contacts used or shown, each circuit breaker shall be provided with four spare auxiliary, two normally open and two normally closed, wired to interconnection terminals. If auxiliary relays are used to provide additional contacts, such relays shall not be of the latching type. Interconnection terminal blocks shall be wired to permit remote open and close operations of each circuit breaker.

2.5.2.1 Sulphur Hexafluoride (SF6) Interrupters

SF6 interrupters shall be of the puffer type where the movement of the contact plunger will initiate the puff of SF6 gas across the contact to extinguish the arc. Breakers shall be provided with a loss-of-pressure-alarm remote as shown on the drawings. Before the pressure in the interrupter drops below the point where the breaker or switch cannot open safely without damage, the breaker shall activate the loss-of-pressure-alarm, open automatically, and remain in the locked open position until repaired. The SF6 shall meet the requirements of ASTM D 2472, except that the maximum dew point shall be minus 60 degrees C (corresponding to 11 ppm water by volume), with only 11 ppm water by volume, and the minimum purity shall be 99.9 percent by weight. Circuit breakers shall have provisions for maintenance slow closing of contacts and have a readily accessible contact wear indicator. Tripping time shall not exceed 3 cycles.

2.5.2.2 Ratings

Circuit Breaker ratings at 60 Hz shall be in accordance with ANSI C37.06 and as follows:

Maximum voltage.....145 kV

Nominal voltage class.....138 kV

Maximum symmetrical interrupting current.....31.5 kA

Continuous current..... as shown 2.5.3

Line Switches

2.5.3.1 Ratings

Ratings at 60 Hz shall be in accordance with ANSI C37.32 and as follows:

Nominal voltage.....138 kV

Rated maximum voltage.....145 kV

Short Time withstand Current.....38 kA

Rated continuous current.....1200 A

2.5.3.2 Standard Devices and Accessories

One set of special tools, as necessary for servicing, shall be provided.

2.5.3.3 Group-Operated Line Switches

Group-operated line switches shall be air-insulated with manual and motor -type operators. Group-operated line switches shall comply with ANSI C37.32, IEEE C37.30, IEEE C37.34, and NEMA SG 6, and shall be three-pole, single-throw, provided with a mechanism which opens the three phases simultaneously. Group-operated switches shall be manually operated and motor operated as indicated.

a. Air-Insulated:

Air-insulated switches shall be of the vertical-break type, with either tilting or rotating insulators, for horizontal upright mounting as indicated. Contact surfaces shall be silver. The switching capability required shall be of the load interrupter type. Switches shall be provided with replaceable contacts, arc horns, and other moving parts which have a limited life expectancy.

c. Load Interrupter Type, Air-Insulated:

Load interrupter switches shall be capable of interrupting load currents equal to their continuous current ratings, which meet the requirements of IEEE C37.30.

d. Disconnecting Type, Air-Insulated:

Disconnecting switches shall be provided with quick-break arcing horns rated for interrupting transformer exciting currents or line charging currents, dependent upon the application. A switch used to protect a power transformer shall be key-interlocked with its associated transformer's tap changer for de-energized operation (TCDO) and its load side circuit breaker disconnect, so that the manual TCDO can be operated only when the transformer is de-energized, and so that the switch can be only opened or closed after its associated circuit breaker has been placed in the open position. A permanent warning sign having letters at least 50 mm high and reading as follows: "WARNING - DISCONNECTING SWITCH - DO NOT OPEN UNDER LOAD" shall be mounted on the switch operating mechanism.

e. Manually-Operated Type, Air-Insulated:

The switch operating handle shall be located approximately 1.1 m above its grounded platform plate. Insulation of the switch operating mechanism shall include both insulated interphase rod sections and the insulated vertical shaft.

2.5.3.4 Switch Operators

Motor operators shall be stored-energy mechanisms having a 48-volt dc , charging motor, with a manual operating mechanism. Opening and closing operating time shall be not more than 6 cycles for each operation. Operators shall be configured so that the switch actuator is padlockable.

a. Operation: The operating mechanism shall permit both manual and electrical operation of the switch at its operating mechanism

cabinet, and electrical operation by the indicated remote control circuitry. The operating shaft or operator cabinet shall be clearly and permanently marked to indicate continuously the positions of the switch. An externally operable decoupler shall be provided at or near the point of entrance of the shaft into its operator housing so as to permit disengagement of the shaft for inspection, tests, maintenance, or repair of equipment located within the operator enclosure. Switch operators shall be provided with contacts for future connection to SCADA system. Systems, components, and equipment shall conform to the requirements and recommendations of IEEE C37.1.

- b. Operating Mechanism Cabinet: A NEMA 250 type 3R enclosure complying with paragraph CABINETS AND ENCLOSURES shall be provided as suitable for the required operation. The electrical devices listed below shall be rated for the application and shall be suitable for the available low-voltage alternating or direct current, specified. Unless otherwise noted, manufacturer's standard devices for the rating specified shall be provided and shall include the following:

- (1) "Trip" and "Close" pushbuttons or switch and position indication lights.
- (2) A switch-operation counter.
- (3) Shaft travel limit switches and any required safety devices.
- (4) A light connected to a cabinet door-actuated switch, so that the light is energized only when doors are open.
- (5) A heater continuously energized to prevent condensation within the cabinet over an ambient temperature range of minus 29 to 40 degrees C at 90% relative humidity and connected to a cabinet door-actuated switch, so that the heater is de-energized when doors are open. High-temperature thermal protection shall be included.
- (6) An operator charging motor with thermal-overload relays.
- (7) A motor control contactor, with relays, solenoids, and any other control devices required.
- (8) Necessary motor-alarm and interlock switches.
- (9) One-pole or two-pole thermal-magnetic, molded-case circuit breakers suitable for the operating voltage for control, heater, and light circuits.
- (10) A minimum of eight spare motor operator auxiliary contacts, four normally open and four normally closed, wired to an interconnection terminal block.
- (11) An interconnection terminal block wired to permit remote open and close operations of the switch and for other required exterior connections.
- (12) A key interlock if indicated or specified.

- (13) A local-remote selector switch and position indication lights.
- (14) Manual trip lever and manual charging handle (in case of loss of control power.
- (15) "Charged" and "Discharged" indicators for stored energy mechanism.
- (16) Gas pressure indicator, or low gas pressure indicator.
- (17) Local/Remote operation selector switch.

2.5.3.5 Grounded Iron Platform Plate

The manually-operated, group-operated switch shall be provided with a grounded platform plate located where the switch operator would stand to manually operate the switch. The plate shall be constructed of hot-dip galvanized iron at least 6 mm thick and shall be approximately 1.2 m in length by 750 mm in width. The plate shall be laid on finished grade and so secured as shown. Two ground clamps shall be provided on the plate on the side adjacent to the switch operating mechanism. Each clamp shall be connected to the station grounding grid with a No. 4/0 AWG bare copper wire. Separate clamps and a flexible copper braid conductor shall be used to connect the plate to the switch operating handle mechanism. The cross sectional area of the braid shall be equivalent to a No. 4 AWG conductor, minimum.

2.6 SUBSTATION EQUIPMENT

The installation shall be of the substation transformer type. The initial capacity of the substation is based on the 55/65 degrees C transformer capacity shown. The number of outgoing distribution feeders shall be as shown. Outgoing circuits shall be three-phase four-wire type having a voltage rating of 12.47 kV phase-to-phase. Outgoing circuit equipment shall be rated for a nominal voltage class of 15 kV and shall have a BIL of not less than 110 kV. Outgoing circuits shall leave the station aerially .

2.6.1 Power Transformer

The power transformer shall comply with IEEE C57.12.00 and shall be of the 55/65 degrees C rise, three-phase, two-winding, mineral-oil-immersed, load-tap-changing type and shall be solidly grounded. Temperature monitoring, indication, and automatically-controlled cooling equipment shall be as specified. The color of the transformer case and auxiliary items shall match the color used for switchgear and cabinets as specified for cabinets in paragraph CABINETS AND ENCLOSURES.

2.6.1.1 Ratings

Transformer losses and impedances shall be measured in accordance with IEEE C57.12.90. Ratings at 60 Hz shall be in accordance with ANSI C57.12.10 and as follows:

- High-voltage winding.....138 kV
- High-voltage BIL.....550 kV
- High-voltage winding connection.....Delta

Low-voltage winding.....	Wye volts
Low-voltage BIL.....	110 kV volts
Low-voltage winding connection.....	Wye
Base kVA.....	15000
Percent impedance	9.5
Maximum no-load (core) losses.....	23 kW
Maximum full-load (winding) losses.....	94 kW

2.6.1.2 Auxiliary Cooling Equipment

Cooling equipment shall be provided for forced-air-cooling/forced-oil cooling utilizing automatic control. Automatic controls, motors, heaters, and their protective devices shall be rated for the application and shall be suitable for the alternating current available as shown or specified. Radiator isolation valves shall be provided for bolted-on radiators. Controls for auxiliary cooling equipment shall combine the transformer top oil thermometer, device 26Q, and the transformer winding temperature simulator, device 49, suitable for responding either to the transformer's top liquid or winding temperature, and shall include auxiliary devices necessary for sensing temperature changes. These devices shall be mounted on the transformer case in a suitable housing so that maintenance is possible without removing the transformer cover or handling oil. Devices 26Q and 49 shall have three electrically independent contacts operating and wired as follows:

- a. First set of contacts set to close at the manufacturer's recommended setting and wired for starting first-stage forced-air-cooled fans.
- b. Second set of contacts set to close at the manufacturer's recommended setting and wired to start pumps for forced-oil-cooling
- c. Third set of contacts set to close at the manufacturer's recommended setting and wired to energize an auxiliary relay, device 49X. The relay shall be mounted in the transformer terminal cabinet . Device 49X shall be properly rated and equipped with not less than three normally open and three normally closed sets of electrically independent contacts. One set of contacts shall be wired to annunciate excessive transformer temperature.

2.6.1.3 Load-Tap-Changing Equipment

Load-tap-changing equipment shall be provided to provide automatic adjustment of a transformer's low-voltage winding voltage. In addition to the basic load-tap-changing equipment requirements listed in ANSI C57.12.10, the load-tap-changing equipment shall include the following:

- a. A light wired in series with the control cabinet door-actuated switch, so that the light is energized only when the door or doors are open.

- b. A heater continuously energized to prevent condensation within the control cabinet over ambient temperature ranges from 29 degrees C (minus 20 degrees F) degrees C (degrees F) to 40 degrees C (104 degrees F) degrees C (degrees F), with both the heater and thermostat contact wired in series with the control cabinet door-actuated switch, so that the heater is de-energized when doors are open. High-temperature thermal protection shall be included.
- c. One-pole or two-pole thermal-magnetic molded-case circuit breakers suitable for the control voltage, when required by the manufacturer, and for low-voltage alternating-current power to control devices, motor, heater, and light circuits.
- d. Terminal blocks wired for proper interconnection with remote items of equipment.
- e. Circulating-current equipment necessary to allow parallel operation of the transformer.
- f. Reverse power flow equipment wired so that the load-tap-changer functions only when electric power flows from high-voltage to low-voltage windings in the transformer.

2.6.1.4 Bushings and Equipment Connection Provisions

Equipment connection provisions shall be provided as specified for Substation Transformer in paragraph SUBSTATION EQUIPMENT. Primary and secondary cover bushings for high- and low-voltage line and neutral connections shall conform to the requirements of IEEE C57.19.00 and IEEE C57.19.01 and shall have the same BIL as the associated power transformer's high- and low-voltage BIL ratings respectively.

2.6.1.5 Accessories

Transformers shall be provided with the accessories listed below. Contact devices for remote control features shall be rated for the application and shall be suitable for the low-voltage ac or dc available, as shown or specified.

- a. A tap-changer for de-energized operation (TCDO) provided with padlock provision.
- b. A liquid-level indicator and relay (device 71L), shall be provided with two sets of normally-open and normally-closed contacts, one set for low-liquid-level and the other set for high-liquid-level. The contacts shall be rated for the application and wired to one annunciator alarm point.
- c. A pressure-vacuum gauge when the transformer is provided with a sealed-tank or inert gas-pressure oil preservation system.
- d. Drain and filter valves.
- e. Lifting, moving, and jacking facilities.
- f. Two transformer case grounding lugs for termination of No. 4/0 AWG bare copper cables.

- g. Sudden Pressure Relay: A sudden pressure relay, device 63SPR, shall be provided as an integral part of the transformer. A set of contacts of device 63SPR shall be wired to energize an auxiliary relay, device 63X, located in the transformer terminal cabinet . A set of contacts of device 63X shall be wired to energize the transformer lockout relay, device 86T. In turn, contacts of device 86T shall be wired to annunciate abnormal transformer pressure [Am#0001 ,trip the main secondary breaker, and open the tranformer switch.]

2.6.1.6 Miscellaneous Items

Miscellaneous items for a transformer shall include the following:

- a. A weatherproof transformer terminal cabinet for circuits which are connected to devices not mounted integrally on a transformer, but remotely. The gauge of metal for the cabinet shall be the manufacturer's standard. Color of the cabinet shall match the color of the associated transformer. The door or doors of the cabinet shall be equipped with padlocking provisions.
- b. Raceway connections and associated interconnection wiring between a transformer terminal cabinet and any remote devices which operate in conjunction with transformer-mounted devices, including necessary wiring for remote control features . Remote control features include the tripping of associated secondary circuit breakers and the actuation of the associated annunciator circuits by the indicated transformer control or accessory contact.
- c. The transformer shall be shipped from the factory already filled with oil, if possible. If the transformer must be vacuum filled in the field, a four inch NPT nipple, with cap for the vacuum line, shall be added to the cover, away from the fill valve.

2.6.2 Substation Transformer

Substation transformer shall comply with the requirements for power transformers in paragraph SUBSTATION EQUIPMENT.

2.7 OUTGOING SWITCHING/CIRCUIT INTERRUPTING EQUIPMENT

Outgoing line switching equipment shall be of the outdoor weatherproof type. Operating characteristics and ratings of outgoing line switching equipment shall be as indicated.

2.7.1 Circuit Breakers

Circuit breakers shall comply with IEEE C37.04 and ANSI C37.06] Circuit breakers shall be of the vacuum type having electrically charged, stored-energy mechanisms which are mechanically and electrically trip free.

A means for manual charging of each trip mechanism shall be provided. Circuit breakers of the same ampere rating shall be interchangeable, both mechanically and electrically. In addition to any contacts used or shown, each circuit breaker shall be provided with four spare auxiliary , two normally open and two normally closed, wired to interconnection terminals. If auxiliary relays are used to provide additional contacts, such relays shall not be of the latching type. Interconnection terminal blocks shall be wired to permit remote open and close operations of each

circuit breaker and for other required exterior connections or connections between switchgear sections.

2.7.1.1 Vacuum Circuit Interrupters

Vacuum interrupters shall be hermetically-sealed in a high vacuum to protect contacts from moisture and contamination. Circuit breakers shall have provisions for maintenance slow closing of contacts and have a readily accessible contact wear indicator. Tripping time shall not exceed 5 cycles.

2.7.1.2 Ratings

Circuit breaker ratings at 60 Hz shall be in accordance with ANSI C37.06 and as follows:

Maximum voltage.....15.5 kV
Maximum symmetrical interrupting current.....20 kA
Continuous current..... as shown

2.8 Station Transformer

Transformers shall comply with IEEE C57.12.00 for general requirements and ANSI C57.12.20 for specific requirements for overhead transformers. Overhead distribution transformers shall be of the outdoor type, mineral-oil-insulated single-phase or three-phase as indicated and have two separate windings per phase. Transformers shall be provided with necessary auxiliary mounting devices suitable for the indicated installation. Transformers shall have two 2-1/2 percent rated kVA high-voltage taps above and below rated primary voltage. Transformer installations shall include one primary fuse cutout and one surge arrester for each ungrounded phase conductor. Self-protected transformers are not acceptable. Transformer tanks shall have a standard gray finish.

2.9 Line Switches

2.9.1 Ratings

Ratings at 60 Hz shall be in accordance with ANSI C37.32 and as follows:

Rated maximum voltage.....15.5 kV
Short Time Withstand Current.....38/44 kA
Rated continuous current.....1200/2000 A

2.9.2 Standard Devices and Accessories

One set of special tools, as necessary for servicing, shall be provided.

2.9.3 Stick (Hook) Operated Line Switches

Stick (hook) operated line switches shall comply with ANSI C37.32 and shall be a stick-operated, single-pole, single-throw, vertical-break switch suitable for vertical mounting as indicated.

2.9.4 Group-Operated Line Switches

Group-operated line switches shall be air-insulated with manual and motor -type operators. Group-operated line switches shall comply with ANSI C37.32, IEEE C37.30, IEEE C37.34, and NEMA SG 6, and shall be three-pole, single-throw, provided with a mechanism which opens the three phases simultaneously. Group-operated switches shall be manually operated and motor operated as indicated.

a. Air-Insulated:

Air-insulated switches shall be of the vertical-break type, with either tilting or rotating insulators, for horizontal upright mounting . Contact surfaces shall be silver. The switching capability required shall be of the disconnecting type. Switches shall be provided with replaceable contacts, arc horns, and other moving parts which have a limited life expectancy.

c. Load Interrupter Type, Air-Insulated:

Load interrupter switches shall be capable of interrupting load currents equal to their continuous current ratings, which meet the requirements of IEEE C37.30.

d. Disconnecting Type, Air-Insulated:

Disconnecting switches shall be provided with quick-break arcing horns rated for interrupting transformer exciting currents or line charging currents, dependent upon the application. A switch used to protect a power transformer shall be key-interlocked with its associated transformer's tap changer for de-energized operation (TCDO) and its load side circuit breaker disconnect, so that the manual TCDO can be operated only when the transformer is de-energized, and so that the switch can be only opened or closed after its associated circuit breaker has been placed in the open position. A permanent warning sign having letters at least 50 mm high and reading as follows: "WARNING - DISCONNECTING SWITCH - DO NOT OPEN UNDER LOAD" shall be mounted on the switch operating mechanism.

e. Manually-Operated Type, Air-Insulated:

The switch operating handle shall be located approximately 1.1 m above its grounded platform plate. Insulation of the switch operating mechanism shall include both insulated interphase rod sections and the insulated vertical shaft.

2.9.5 Switch Operators

Motor operators shall be stored-energy mechanisms having a 24-volt dc, charging motor, with a manual operating mechanism. Opening and closing operating time shall be not more than 6 cycles for each operation. Operators shall be configured so that the switch actuator is padlockable.

- a. Operation: The operating mechanism shall permit both manual and electrical operation of the switch at its operating mechanism cabinet, and electrical operation by the indicated remote control circuitry. The operating shaft or operator cabinet shall be clearly and permanently marked to indicate continuously the

positions of the switch. An externally operable decoupler shall be provided at or near the point of entrance of the shaft into its operator housing so as to permit disengagement of the shaft for inspection, tests, maintenance, or repair of equipment located within the operator enclosure. Switch operators shall be provided with contacts for future connection to SCADA system. Systems, components, and equipment shall conform to the requirements and recommendations of IEEE C37.1.

- b. Operating Mechanism Cabinet: A NEMA 250 type 3R enclosure complying with paragraph CABINETS AND ENCLOSURES shall be provided as suitable for the required operation. The electrical devices listed below shall be rated for the application and shall be suitable for the available low-voltage alternating or direct current, specified. Unless otherwise noted, manufacturer's standard devices for the rating specified shall be provided and shall include the following:

- (1) "Trip" and "Close" pushbuttons or switch and position indication lights.
- (2) A switch-operation counter.
- (3) Shaft travel limit switches and any required safety devices.
- (4) A light connected to a cabinet door-actuated switch, so that the light is energized only when doors are open.
- (5) A heater continuously energized to prevent condensation within the cabinet over an ambient temperature range of minus 29 to 40 degrees C at 90% relative humidity and connected to a cabinet door-actuated switch, so that the heater is de-energized when doors are open. High-temperature thermal protection shall be included.
- (6) An operator charging motor with thermal-overload relays.
- (7) A motor control contactor, with relays, solenoids, and any other control devices required.
- (8) Necessary motor-alarm and interlock switches.
- (9) One-pole or two-pole thermal-magnetic, molded-case circuit breakers suitable for the operating voltage for control, heater, and light circuits.
- (10) A minimum of eight spare motor operator auxiliary contacts, four normally open and four normally closed, wired to an interconnection terminal block.
- (11) An interconnection terminal block wired to permit remote open and close operations of the switch and for other required exterior connections.
- (12) A key interlock if indicated or specified.
- (13) A local-remote selector switch and position indication lights.

(14) Manual trip lever and manual charging handle (in case of loss of control power.

(15) "Charged" and "Discharged" indicators for stored energy mechanism.

(16) Gas pressure indicator, or low gas pressure indicator.

(17) Local/Remote operation selector switch.

2.10 SUBSTATION AND SWITCHGEAR PROTECTIVE RELAYS

2.10.1 General

Microprocessor-based protective relays shall be provided as shown and shall be of a type specifically designed for use on power switchgear or associated electric power apparatus. Protective relays shall conform to IEEE C37.90. Relays and auxiliaries shall be suitable for operation with the instrument transformer ratios and connections provided.

2.10.2 Construction

Relays shall be of the semi-flush, rectangular, back-connected, dustproof, switchboard type. Cases shall have a black finish and window-type removable covers capable of being sealed against tampering. Relays shall be of a type that can be withdrawn, through approved sliding contacts, from fronts of panels or doors without opening current transformer secondary circuits, disturbing external circuits, or requiring disconnection of any relay leads. Necessary test devices shall be incorporated within each relay and shall provide a means for testing either from an external source of electric power or from associated instrument transformers. Each relay shall be provided with an operation indicator and an external target reset device. Relays shall have necessary auxiliaries for proper operation. Relays and auxiliaries shall be suitable for operation with the instrument transformer ratios and connections provided.

2.10.3 Ratings

Relays shall be the manufacturer's standard items of equipment with appropriate ranges for time dial, tap, and other settings. Relay device numbers shall correspond to the function names and descriptions of IEEE C37.2.

2.10.4 Overcurrent Relays

Overcurrent relays shall be [Am#0001 multifunction, nondirectional, microprocessor-based type, providing device functions as indicated on the drawings. Pickup range shall be 0.5-12A. Characteristic curves shall be inverse.]

2.10.5 Automatic Reclosing Relay

Relay, device 79, shall be of the three-phase, four-reclosure type, providing immediate initial reclosure, and three time-delay reclosures. Adjustable time delays shall be 10 to 60 seconds for reset and 0 to 45 seconds for reclosing. Units shall have instantaneous trip lockout after any preset trip or when closing in on a fault. Auxiliary devices shall provide for lockout when an associated circuit breaker is tripped after three reclosures and automatically reset when an associated circuit breaker

is not tripped after any reclosure.

2.10.6 Bus Differential and Lockout Relays

Bus differential relay, device 87B, shall be of the three-phase or single-phase, high-speed impedance differential type suitable for protection of buses. Lockout relay, device 86B, shall be of a type which, when used in conjunction with the 87B relay, trips and locks out the indicated circuit breaker.

2.11 Control and Instrument Switches

Control and instrument switches shall be of the rotary switchboard type rated for alternating-current operation at 600 volts, or direct-current operation at 250 volts for dc circuits, as applicable. Contacts shall be rated for not less than a continuous current of 20 amperes, shall be of the silver-to-silver type, and shall have positive means for maintaining contact. Each switch shall be provided with a black operating handle, and an escutcheon clearly marked to show each operating position. Switch identifications and handle positions shall be engraved on escutcheons or may be provided on separate nameplates. Escutcheon engravings shall be white on a black background or black on a white background. Instrument switches for potential phase selection shall be provided with an oval handle. Ammeter switches for phase selection shall have round, notched, or knurled handles and equipped with short-circuiting type of contacts to prevent open-circuiting of current transformer secondary circuits in any position of the ammeter switches. Switches provided for circuit breaker control and local-remote selector switches shall have a pistol-grip handle and a mechanical target to indicate the last operating position of the switch. Red and green circuit breaker position indication LED lights shall be installed immediately above each circuit breaker switch. Local-remote selector switches shall be provided only when shown or specified. Position indication lights shall be installed immediately above selector switches, with blue LED lights indicating remote control and amber LED lights indicating local control.

2.12 Electrical Indicating Instruments

Electrical indicating instrument relays shall comply with ANSI C12.1, ANSI C12.4, ANSI C12.10, and ANSI C39.1. Electrical indicating instruments shall be of the semiflush, back-connected, dustproof, direct-reading, switchboard type. Electrical instrumentation devices shall be compatible as a system, sealed, dust tight, utilizing modular components with digital instrumentation. Display shall utilize LED or back-lit LCD. Numeral height shall be 10 mm minimum.

2.12.1 Electronic Power Meters

Front panel shall contain a scrollable LCD displaying up to 16 characters per line. Meter shall be programmable providing demand reset, engery reset, meter intialization, data formatting, and errors clearing functions. Meter shall be provided with programmable pulse initiator output. The following display functions shall be included:

- a. RMS current for each phase and neutral.
- b. RMS voltage for each phase-to-neutral and each phase-to-phase.

- c. Watts for each phase and total.
- d. Demand watts.
- e. Peak demand watts.
- f. Vars for each phase and total.
- g. Voltamperes for each phase and total.
- h. Power factor, total.
- i. Total watthours.
- j. Total lagging and leading varhours.
- k. Total voltamperehours.
- l. Frequency in hertz.

2.13 Specific Unit Requirements

In addition to the basic circuit breaker unit requirement, each individual unit or section shall contain other devices as required for the application. The following requirements are not to be considered complete in every detail and miscellaneous equipment and devices necessary for correct operation, as indicated or specified, shall be provided as necessary. Protective relays, meters, instruments, and control and instrument switches, shall be mounted in the control building and located as indicated.

2.13.1 Main Secondary Units

Units shall be provided for the protection of outgoing feeder bus and shall include the following:

- a. [Am#0001 Nine] current transformers.
- b. Electronic Power Meter.
- c. [Am#0001 Multifunction overcurrent relay]
- e. One three-phase or three single-phase bus differential relays device 87B, and an auxiliary lockout relay, device 86B, arranged to trip and lock out the associated circuit breaker and other circuit breakers as indicated.
- f. Three- phase secondary potential test blocks with associated test devices, quantity as shown.
- g. Three- phase secondary current test blocks with associated test devices, quantity as shown.

2.13.2 Feeder Units

Units shall be provided for the protection of outgoing feeder circuits and shall include the following:

- a. Nine current transformers.
- b. Electronic Power Meter.
- c. [Am#0001 Multifunction overcurrent relay]
- e. An automatic-reclosing relay, device 79.
- f. Three phase secondary potential test blocks with associated test devices, quantity as shown.
- g. Three phase secondary current test blocks with associated test devices, quantity as shown.

2.14 INSTRUMENT TRANSFORMERS

2.14.1 General

Instrument transformers shall comply with ANSI C12.11 and IEEE C57.13. Instrument transformers shall be configured for mounting in/on the device to which they are applied. Polarity marks on instrument transformers shall be visually evident and shown on drawings.

2.14.2 Current Transformers

Unless otherwise indicated, bar, wound, or window-type transformers are acceptable; and except for window-type units installed over insulated buses, transformers shall have a BIL rating consistent with the rated BIL of the electric power apparatus bushings, buses or conductors. Current transformers shall have the indicated ratios. [Am#0001 Current transformers for metering service shall be rated 200:5, 0.3 thru B-0.1, RF 4.0 and 600:5, 0.3 thru B-0.5, RF 3.0. Current transformers for relaying service shall be multiratio type rated C400.] Other thermal and mechanical ratings of current transformers and their primary leads shall be coordinated with the design of the circuit breaker and shall be not less than the momentary rating of the associated circuit breaker. Circuit protectors shall be provided across secondary leads of the current transformers to prevent the accidental open-circuiting of the transformers while energized. Each terminal of each current transformer shall be connected to a short-circuiting terminal block in the circuit interrupting mechanism cabinet, power transformer terminal cabinet, and in the associated instrument and relay cabinets.

2.14.2.1 Current Transformers for Power Transformers

Single-ratio bushing type current transformers shall be provided in [Am#0001 transformer] bushing wells as required for automatic load tap changer.

2.14.3 Voltage Transformers

Voltage transformers shall have indicated ratios. Units shall have an accuracy class rating of M. Voltage transformers shall be of the drawout type having current-limiting fuses in both primary and secondary circuits. Mechanical interlocks shall prevent removal of fuses, unless the associated voltage transformer is in a drawout position. Voltage transformer compartments shall have hinged doors.

2.15 AUXILIARY SUBSTATION EQUIPMENT

2.15.1 Line Trap

[Am#0001 Deleted]

2.15.2 Station Battery

The station battery installation shall include a battery, battery racks, a battery charger, and protective equipment. A second duplicate battery with automatic switchover will be provided for full capacity backup. The station battery installation shall be housed in the control building.

2.15.2.1 Battery

The battery shall consist of the required number of 12-volt lead-calcium cells interconnected with proper connectors provided by the battery manufacturer to provide a nominal battery rating of 48 volts. Battery shall be of the maintenance free, sealed gel type producing very low gassing due to recombination. Rubber or plastic numerals, of at least 1 inch in height, shall be provided by the battery manufacturer for field attachment to permit proper cell identification. The battery shall have an ampere-hour capacity equal to at least 125 percent of the station's direct-current requirements including normal continuous loads plus intermittent loads. Normal continuous load capacity shall be adequate for an 8-hour period. Intermittent load capacity shall be adequate so that at least three openings and three closings of each of the station's associated circuit breakers and motor-operated switches can occur in an 8-hour period with no more than three circuit breaker or switch units simultaneously operating. Battery circuits shall be ungrounded. Batteries shall have a 10-year minimum design life at 20 degrees C ambient temperature.

2.15.2.2 Battery Racks

Battery racks shall have welded steel frames and rails finished with two coats of paint of a color matching the battery charger enclosure. Racks shall be no more than two tiers high and top tiers shall be low enough to permit maintenance to be done by personnel standing at floor level. Rails shall have a top covering of plastic or rubber at least 1.6 mm (1/16 inch) thick. Paint, rubber, and plastic shall resist corrosion and action of the electrolyte. The installation shall be provided with a portable hydrometer syringe and thermometer. Where recommended by the manufacturer, the installation shall include a cell lifter.

2.15.2.3 Battery Charger

The battery charger shall comply with UL 1236 and shall be a constant voltage, filtered, voltage-regulated, fully automatic type rated for full-float charging of the associated battery. The battery charger shall be convection cooled and suitable for operation on electric power supplied from the associated low-voltage alternating-current panelboard, shall have adequate capacity to fully recharge the associated depleted battery in not more than 8 hours while supplying normal direct-current loads, and shall have an efficiency of not less than 90 percent. The battery charger shall have input and output circuit breakers which automatically disconnect the battery charger when faults occur. The battery charger shall have an output ammeter and voltmeter, and equalizing-float selector switch, and an equalizing timer with a range of 0 to 24 hours. The battery charger enclosure shall be painted as specified for indoor cabinets in paragraph CABINETS AND ENCLOSURES and shall be provided with wall mounting brackets or shall be free-standing as required by its size and weight. A relay for sensing loss of alternating-current input, and an adjustable relay for

sensing that the battery charger output voltage has fallen to a pre-set level, shall be installed on the battery charger to actuate the associated annunciator circuits. DC ground detector LED lights shall be provided.

2.15.3 Capacitor Equipment

Capacitors shall comply with IEEE Std 18. Capacitor equipment shall be outdoor type, rack mounted, block type consisting of two bushing individual capacitors. Insulation shall be an environmentally acceptable dielectric type. A blue marking label, visible from the ground, shall be used to indicate non-PCB. Blocks shall be supplied with properly sized, bus-mounted, indicating-type fuses for individual capacitors. Capacitor units shall have an internal discharge resistor to reduce the residual charge to 50 volts or less within 5 minutes. Capacitors shall be grounded to the rack frame. Provision shall be made to aerial service to the equipment.

2.15.3.1 Ratings

Capacitor equipment to be connected to a 7200/12470 volt, 3-phase, 4-wire grounded wye system. Kvar rating shall be as shown on the plans. Ratings at 60 Hz shall be:

Voltage.....12470 volts
BIL.....95kV
Symmetrical Interrupting
Current(Min.).....10 kA

[Am#0001

2.15.3.2 Capacitor Switch

Capacitor switch shall be three phase, electrically operated, oil switch, specifically rated for capacitor switching. Ratings shall be as follows:

Voltage.....14.4kV
BIL.....110kV
Current.....400A
One Second Symmetrical
Current.....10kA

]

2.15.3.3 Annunciator System

The annunciator system shall consist of the station's audible and visual indicator and an annunciator cabinet. The cabinet shall house an annunciator drop for each component malfunction indicated plus a system pushbutton and flasher and shall be located in where indicated. Electrical devices required shall be rated for the application and shall be suitable for the low-voltage alternating-current available as shown or specified. Auxiliary devices shall be provided as necessary for correct operation.

2.15.3.4 Station Audible and Visual Indication

One station horn and the indicated number of station red alarm lights shall be installed where shown. The station horn shall be weatherproof and shall be of the resonating type having an audible output of not less than 100 dB at 3.1 m (10 feet). Station lights shall be 25-watt incandescent with guards and red globes, shall be UL listed as enclosed and gasketed for use in wet locations, and shall be of a style suitable for the indicated mounting. A horn silencing relay shall be wired in series with the horn so that, after an adjustable time delay of 5 to 15 minutes, the horn shall be silenced. Necessary auxiliary devices provided in conjunction with the horn shall permit signalling to a remote central point.

2.15.3.5 Operating Modes

The system shall be wired so that when the component being monitored by an annunciator is operating correctly, the associated annunciator relay actuates the normal mode, and when the component malfunctions, the associated annunciator relay actuates the alert mode. During normal mode no part of the system shall be energized by the associated annunciator relay. Upon equipment malfunction, the alert mode shall energize the system flasher which shall turn the associated annunciators lights on and off, and sound the station horn, including turning on the station exterior visual indication lights. Depressing the station pushbutton shall turn off the horn, the station visual indication lights, and the flasher, but shall leave the associated annunciator lights on. Correction of a malfunction shall automatically return the alarm system to the normal mode for the associated annunciator relay. Turning the system pushbutton during a normal mode shall simulate an alert mode for all annunciator relays so that correct operation of annunciator lamps, the station exterior visual indication lights, the system flasher, and the station horn can be checked.

2.15.3.6 Annunciators

Annunciators shall comply with ISA S18.1 and shall be solid-state logic, modular, hermetically sealed, plug-in relays each with two integral long-life lamps for backlighting a white translucent nameplate window of not less than 5 x 75 mm. Nameplates shall have black letters at least 3 mm in height and the inscription shall match the indicated malfunction description.

2.15.3.7 Other Requirements

The annunciator cabinet shall be suitable for the indicated location and shall conform to requirements specified herein for cabinets. The flasher frequency shall be between 1 and 5 Hz. The system pushbutton shall be provided with a nameplate inscribed "PUSH TO SILENCE" and "TURN TO TEST."

2.16 CABINETS AND ENCLOSURES

Cabinets and enclosures shall comply with NEMA 250 and shall be of galvanized steel, shall be provided with hinged doors, and shall be suitable for indoor or outdoor installation as indicated. Where locations are not indicated, cabinets shall be suitable for outdoor installation. Thickness of metal and outdoor construction shall be in accordance with UL 50. An indoor cabinet exterior shall have one finish coat and an outdoor cabinet exterior shall have two finish coats. Finish colors shall be manufacturer's standard dark gray or sky gray for outdoor cabinets and

light gray for indoor cabinets, unless otherwise specified. The finish color of outdoor equipment shall be the same unless otherwise approved. Finish coats shall be applied over a prepared substrate. A concrete pad shall be provided to support any outdoor cabinet whose base extends to within 75 mm of grade level and pads shall extend at least 100 mm below grade.

[Am#0001 2.16A RELAY AND CONTROL PANELS

Panel layouts and locations shall be as shown on the drawings. Panels shall be free standing, self-supporting steel with an open rear and shall be secured to the floor with appropriate anchors. Panels shall be 610mm wide by 200mm deep by 2.3m high with 229mm side extension for support. Supports shall be 89mm min. Panels shall be prefabricated and prewired. Equipment shall be mounted in panels in accordance with manufacturer's recommendations. Terminal strips shall be provided for all incoming wiring.]

2.17 MISCELLANEOUS

2.17.1 Wiring

Wiring between separate items of station equipment shall conform to the requirements of Section 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL and 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Solid wiring may be used for convenience outlets, heating elements, and lighting circuits. Otherwise, the minimum class of stranding shall be Class C. Class K stranding shall be used for wiring between items of equipment mounted on swinging panels or doors and items mounted on fixed panels or parts of fixed assemblies. The insulation type shall be the type SIS unless otherwise specified, indicated, or proposed and approved for use. The minimum wire gauge shall be No. 14 AWG, except No. 18 AWG may be used for circuits that use one ampere or less. Circuits rated less than 115 volts ac or 125 volts dc may be wired with wiring rated 300 volts-to-ground. Otherwise, all wiring shall be rated for 600 volts ac and 250 volts dc. Current transformer circuit wiring shall be not less than No. 10 AWG. Wiring for Close and Trip circuits shall be not less than No. 8 AWG. Wire markers shall be affixed to each end of wires and shall contain wire number or designations shown on contract or detail drawings, or as otherwise approved. Wire numbers shall also be permanently marked on terminal block marking strips where wires are connected. Only insulated-barrel, crimp-type, ring lugs shall be used.

2.17.2 Single-Line Electrical Diagram

A single-line electrical diagram of the station shall be provided. The diagram shall be enclosed between matte-surface thermoplastic sheets buttoned or otherwise suitably fastened together to allow easy access to the diagram for making any future changes. The diagram shall be suitable for outdoor mounting and shall be approximately 350 x 525 mm unless another size is approved. The diagram shall be attached with temperature- and moisture-resistant, pressure-sensitive adhesive or with other suitable means to the indicated location at the metal-clad switchgear lineup, except when otherwise shown or directed.

2.17.3 Liquid Dielectrics

Liquid dielectrics for transformers, capacitors, reclosers, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl

(PCB) mineral-oil or less-flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 Trichlorobenzene (TCB) fluid shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than 50 parts-per-million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with ASTM D 923 and have tests performed per ASTM D 4059 at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding 50 ppm shall be replaced.

2.17.4 Danger Signs

One danger sign inscribed "DANGER-HIGH VOLTAGE" shall be permanently and securely mounted approximately 1/5 m above finished grade on each outward side of the fence enclosure. Fasteners shall be of stainless steel. Signs shall be of metal and shall have letters of at least 75 mm in height. Voltage warning signs shall comply with IEEE C2.

2.17.5 Concentric-Lay-Stranded Conductors

Copper conductors shall comply with ASTM B 8 for soft drawn copper. Equivalent aluminum conductors shall comply with ASTM B 231/B 231M.

2.17.6 Conduits, Rigid Metal

Conduits shall comply with UL 6.

2.17.7 Hardware

Ferrous metal threaded items shall comply with ASTM A 153/A 153M and miscellaneous nonthreaded items shall comply with ASTM A 123/A 123M. Other equivalent protective treatment, as required by ASTM A 123/A 123M or ASTM A 153/A 153M, or ferrous metals designed to meet ASTM Standards covering corrosion-resisting steel, will be permitted if approved in writing.

2.17.8 Padlocks

Padlocks shall comply with Section 08710 DOOR HARDWARE

2.18 GROUNDING AND BONDING

2.18.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to UL 467 not less than 15.9 mm (5/8 inch) in diameter by 3.1 m (10 feet) in length .

2.18.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as the phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.19 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1, IEEE C62.1, IEEE C62.2, and IEEE C62.11, and shall be provided as indicated. Arresters shall be station class, rated as shown. Arresters shall be equipped with mounting

brackets for the indicated installations. Arresters shall be of the metal-oxide varistor type suitable for outdoor installations.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Circuits installed in conduits or underground and splices and terminations for medium-voltage cable shall conform to the requirements of Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Secondary circuits installed in conduit on poles shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of NFPA 70 and IEEE C2.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall notify the Contracting Officer of any discrepancy before performing any work.

3.1.3 Concrete Foundations

3.1.3.1 Structure Foundation Installation

[AM#0001 Concrete foundations, designed by the Contractor, shall have anchor bolts accurately set in foundations using templates supplied by the pole manufacturer. Each structure shall be bolted to a concrete foundation by at least four bolts per column, spaced to transmit structure stresses to the foundation. Diameters and lengths of foundation bolts shall be as recommended by the structure manufacturer and not less than necessary to meet the pole wind loading specified herein and other design requirements..

Bolts shall be embedded in concrete in a manner to develop their full strength. When concrete has cured, structure baseplates shall be leveled and grouted in place. Columns shall then be set on baseplates, leveled on foundations, and secured with holding nuts. Concrete work and grouting shall comply with the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

Design calculations for the foundations shall be approved before installation of the foundations are permitted. Calculations shall be submitted in accordance with the design data portion of paragraph entitled "SUBMITTALS."]

3.1.3.2 Concrete Pads

Concrete pads for pad-mounted electrical equipment shall be constructed as indicated. Tops of concrete pads shall be level and shall project four inches above finished paving or grade and sloped to drain. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placing of concrete pads. Concrete work shall comply with the requirements of Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. If the equipment primary compartment is not of sufficient height to allow the installation of the medium-voltage terminators, load break elbows or switches, the Contractor shall provide adequate space by providing a rectangular hole in

the concrete pad below the primary compartment and/or a factory prefabricated steel adjustment ring around the entire perimeter of the base of the equipment. Steel rings shall be factory manufactured to fit the base of the equipment of which they support and shall be factory painted to match the equipment enclosure. Steel base rings shall be constructed using the same or greater thickness of steel as the equipment being supported. Concrete pads to support pad mounted electrical equipment shall be reinforced. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment housing with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, and foreign matter.

3.1.4 Fencing

The station shall be enclosed by chain-link fence as shown. Fencing is specified in Section 02821 CHAIN-LINK FENCE and shall be grounded in accordance with paragraph GROUNDING.

3.1.5 Surface Treatment

Horizontal spaces between concrete foundations or pads and fences shall be excavated to minimum depth of 150 mm (6 inches) mm (inches) below finished gradelines, shall be graded to level surfaces, and filled with well-compacted clean coarse gravel or crushed stone of 15 to 38 mm in size up to finished gradelines.

3.1.6 Spare Accessory Storage

A cabinet shall be provided for storage of equipment accessories as necessary, including spare fuses, fuse tongs, switch sticks, and other tools and located where indicated. Shelves or other appropriate supporting methods shall provide an individual space for each type of item stored.

3.1.7 Fire Extinguisher Storage

An outdoor cabinet for housing a Government-provided, hand-operated, self-expellent, carbon dioxide fire extinguisher of 4.5 kg (10 pounds) to 6.8 kg (15 pounds) capacity for Class C fires shall be provided and located as approved. The cabinet shall have a glass cover door and be painted red.

3.1.8 Field Welding

Procedures and welders shall be qualified in accordance with AWS D1.1 for structural welding and ASME BPVC SEC IX for welding of equipment. Welding procedures qualified by others, and welders and welding operators qualified by a previously qualified employer may be accepted as permitted by ASME B31.3. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practical. The Contracting Officer shall be provided with a copy of qualifying procedures and a list of names and identification symbols of qualified welders and welding operators. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Gas-metal arc welding shall be performed by welders certified to perform gas-metal arc welding.

3.1.9 Connections to Utility Lines

The Contractor shall coordinate the work with the Contracting Officer and shall provide final connections to the installation electric lines. Connections to transmission line shall be made by utility company.

3.1.10 Disposal of Liquid Dielectrics

PCB contaminated dielectrics must be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectric shall not be diluted to lower the contamination level.

3.2 EQUIPMENT INSTALLATION

3.2.1 Transformer Stations

Transformer stations shall be installed in accordance with IEEE C57.93 and shall be fence-enclosed type and mounted on concrete pads.

3.2.2 Equipment Finishes

Equipment shall be carefully installed so as not to scratch finishes. After installation, finished surfaces shall be inspected and scratches touched up with a finish provided by the manufacturer especially for this purpose.

3.2.3 Supports

Enclosures and enclosure supports shall be installed in accordance with manufacturer's instructions. Supports shall consist of anchored channels leveled and then embedded in the concrete foundation. Channels, anchors, shims, or other leveling items shall be installed in accordance with the recommendations of the equipment manufacturer.

3.2.4 Incoming Line Surge Arresters

Surge arresters of the station type shall be provided on each phase of each incoming line circuit, and mounted on station structures as shown.

3.2.5 Transformer Surge Arresters

Surge arresters of the station type, suitable for an ungrounded system and for the associated transformer primary line-to-ground voltage, shall be mounted next to each high-voltage bushing on a transformer tank-mounted bracket and connected to a surge arrester ground pad. Discharge counters shall be provided and mounted on the brackets.

3.3 ELECTRICAL BUS CONNECTIONS

All connections to aluminum bus shall be cleaned and coated with an inhibitor in accordance with manufacturer's recommended methods. All bolted connections shall be torqued to the correct tightness. The Contractor shall establish a checklist to insure that bolted connections have been properly coated and correctly torqued. All welded connections on aluminum buswork shall be by the gas metal-arc welding process. The shield inert gas shall be argon. The welder shall be certified for gas metal-arc welding.

3.4 GROUNDING

A grounding grid, consisting of the indicated configuration of bare copper conductors and driven ground rods shall be installed as shown on the drawings. Grounding grid shall comply with IEEE Std 80. Equipment frames of metal-enclosed equipment, medium-voltage cable terminations, chain-link fencing, metal-structures, and other noncurrent-carrying metal items shall be connected to the ground grid as shown. At least two connections shall be provided from a power transformer, to the ground grid. Fences shall be grounded at each fixed gate post, each corner post, and at intermediate posts as indicated. Each gate section shall be bonded to its gate posts with a 3.2 mm (1/8 inch) x 25.4 mm (1 inch) flexible braided copper strap and ground post clamps. Fence ground clamps shall be of a type that inhibits corrosion between metal parts. Outriggers shall be grounded as shown.

3.4.1 Grounding Electrodes

Grounding electrodes shall be as follows:

- a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are approximately one foot below finished grade.
- b. Grid grounding electrodes - A grid grounding electrode shall be installed as shown consisting of bare copper conductors installed 600 mm, plus or minus 75 mm, below the finished top of soil grade. Grid conductors shall be bonded to all rod electrodes, and to all other intersecting grid conductors. Grid conductors shall be sized as shown.

3.4.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with UL 467, and those below grade shall be made by the fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.4.3 Grounding and Bonding Conductors

Grounding and bonding conductors include all conductors used to bond transformer enclosures, equipment frames and structural members to the grounding grid. Grounding and bonding conductors shall be sized as shown. After being located to provide maximum physical protection, exposed grounding conductors shall be securely attached to structural supports at not more than two foot intervals with suitable fasteners. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete should be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.4.4 Surge Arrester Grounding

Surge arresters and neutrals shall be bonded directly to the transformer enclosure and then to the grounding grid with a bare copper conductor,

minimum size 4/0 . Lead lengths shall be kept as short as practicable with no kinks or sharp bends.

3.5 FIELD TESTING

3.5.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 14 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

3.5.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.5.3 Ground-Resistance Tests

The resistance of the grounding grid shall be measured using the fall-of-potential method defined in IEEE Std 81. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements.

Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms .
- b. Grid electrode - 1 ohms.

3.5.4 Ground-Grid Connection Inspection

All below-grade ground-grid connections will be visually inspected by the Contracting Officer before backfilling. The Contractor shall notify the Contracting Officer 48 hours before the site is ready for inspection.

3.5.5 Liquid-Filled Transformer Tests

The following field tests shall be performed on all liquid-filled transformers 2000 kVA and above.

- a. Insulation resistance test phase-to-ground.
- b. Turns ratio test.
- c. Correct phase sequence.

d. Correct operation of tap changer.

3.5.6 Protective Relays

Protective relays shall be visually and mechanically inspected, adjusted, tested, and calibrated in accordance with the manufacturer's published instructions. Tests shall include pick-up, timing, contact action, restraint, and other aspects necessary to insure proper calibration and operation. Relay settings shall be implemented in accordance with the coordination study. Relay contacts shall be manually or electrically operated to verify that the proper breakers and alarms initiate. Relaying current transformers shall be field tested in accordance with IEEE C57.13.

3.5.7 Pre-Energization Services

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing company with a minimum of two years of current product experience. No part of the electrical system shall be energized until all station grounding components have been tested and demonstrated to comply with the specified requirements. The following services shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be inspected to insure that installation is in compliance with the recommendations of the manufacturer and as shown on the detail drawings. Terminations of conductors at station buses and at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated conductors between such terminations shall be inspected to detect possible damage caused during installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be inspected for damage during installation or shipment and to verify that packaging materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components capable of being calibrated, adjusted, and tested shall be calibrated, adjusted, and tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided include, but are not limited to, are the following:

Battery, station.

Breakers, circuit.

Buses, station aerial.

Switches, disconnect without power fuses.

Switches, air-break.

Switchgear, metal-clad.

Switchgear, metal-enclosed interrupter.

Transformers, substation.

3.5.8 Operating Tests

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph TEST REPORTS.

3.6 MANUFACTURER'S FIELD SERVICE

3.6.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 16 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape of the entire training session shall be submitted.

3.6.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests, initial operation, and instruct personnel as to the operational and maintenance features of the equipment.

3.7 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation material or operation have been corrected.

-- End of Section --