

2. AMENDMENT/MODIFICATION NO. 0006	3. EFFECTIVE DATE 24 AUG 98	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
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6. ISSUED BY  Department of the Army Corps of Engineers Fort Worth District	CODE	7. ADMINISTERED BY (If other than Item 6)	CODE
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8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)	(√)	9A. AMENDMENT OF SOLICITATION NO. DACA63-98-B-0040
	X	9B. DATED (SEE ITEM 11) 27 JULY 1998
		10A. MODIFICATION OF CONTRACTS/ORDER NO.
		10B. DATED (SEE ITEM 13)
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 1 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 you 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 APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

(√)	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) 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 (such as changes in paying office, appropriation date, etc.) 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 (Specify type of modification and authority)

**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.)  
 The Solicitation for GENERAL INSTRUCTION BUILDING, PHASE 1, FORT HOOD, TEXAS, is amended as follows:

See Continuation Sheet.

NOTE: Bid Opening Date remains "3 SEPTEMBER 1998, 2 p.m., local time" as previously announced.

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

Item 14. Continued.

a. Bidding Schedule.

The Bidding Schedule shall be voided and the accompanying new Bidding Schedule, bearing the notation "ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-98-B-0040", shall be substituted therefor.

b. Specifications

Reissued Sections. - The following listed sections shall be voided and the accompanying new sections of the same title and number, each bearing the notation "ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-98-B-0040" shall be substituted therefor:

Section

No. Title

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02575	PAVEMENT REMOVAL
03250	EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS
04255	NONBEARING MASONRY VENEER/STEEL STUD WALLS
07532	ELASTOMERIC SHEET ROOFING SYSTEM (CSPE)
08110	STEEL DOORS AND FRAMES
08330	OVERHEAD ROLLING DOORS
08353	OPERABLE PARTITIONS
08700	BUILDERS' HARDWARE
09000	BUILDING COLOR AND FINISH SCHEDULE
09310	CERAMIC TILE
10270	RAISED FLOOR SYSTEM
10440	INTERIOR SIGNAGE
15330	WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
16415	ELECTRICAL WORK, INTERIOR (Lighting Fixtures remain unchanged)

c. Drawings.

Reissued Drawings.- The drawings listed below shall be voided and the attached new drawings of the same number, each bearing the notation "AM #0006", shall be substituted therefor:

Sequence No.

Seq 2	C-2	SITE DEVELOPMENT PLAN & BID OPTIONS
Seq 69	A- 1	FIRST FLOOR LIFE SAFETY PLAN
Seq 70	A-2	SECOND FLOOR LIFE SAFETY PLAN
Seq 72	A-4	SECOND FLOOR - OVERALL PLAN
Seq 75	A-7	AREA "C" FIRST FLOOR & REF'L. CL'G. PLAN
Seq 77	A-9	AREA "E" FIRST FLOOR & REF'L. CL'G. PLAN
Seq 78	A-10	AREA "F" FIRST FLOOR & REF'L. CL'G. PLAN
Seq 80	A-12	AREA "C" SECOND FLOOR & REF'L. CL'G. PLAN
Seq 82	A-14	AREA "E" SECOND FLOOR & REF'L. CL'G. PLAN
Seq 83	A-15	AREA "F" SECOND FLOOR & REF'L. CL'G. PLAN
Seq 89	A-21	BUILDING SECTION - AREAS B-C-D-E&F
Seq 90	A-22	BUILDING SECTION - AREAS A-E & F
Seq 91	A-23	WALL SECTIONS
Seq 92	A-24	WALL SECTIONS

Seq 93 A-25 WALL SECTIONS  
Seq 94 A-26 WALL SECTIONS  
Seq 95 A-27 WALL TYPES  
Seq 96 A-28 ENLARGED FLOOR PLANS AND ELEVATIONS  
Seq 98 A-30 DOOR-WINDOW & LOUVER SCHEDULES  
Seq 106 A-38 INTERIOR SIGNAGE PLAN - FIRST FLOOR  
Seq 107 A-39 INTERIOR SIGNAGE PLAN - SECOND FLOOR  
Seq 109 A-41 INTERIOR SIGNAGE SCHEDULE  
Seq 110 A-42 OVERALL FURNITURE PLAN - FIRST FLOOR  
Seq 111 A-43 OVERALL FURNITURE PLAN - SECOND FLOOR  
Seq 116 S-2 FOUNDATION PLAN - AREAS A, E & F  
Seq 142 M6 HVAC PLAN - AREA E & F - FIRST FLOOR  
Seq 144 M8 HVAC PLAN - AREA E & F - SECOND FLOOR  
Seq 164 FP1 FIRST FLOOR FIRE PROTECTION PLAN  
Seq 166 FP3 FIRE PROTECTION DETAILS  
Seq 186 E20 LIGHTING PLAN AREA E & F - FIRST FLOOR  
Seq 188 E22 LIGHTING PLAN AREA E & F - SECOND FLOOR  
Seq 190 E24 POWER & COMMUNICATION PLAN AREA E & F - FIRST FLOOR  
Seq 192 E26 POWER & COMMUNICATION PLAN AREA E & F - 2ND FLOOR

General Instruction Building - Phase I (Title)  
Fort Hood, Texas (Location)

Solicitation No. DACA63-98-B-0040

**BIDDING SCHEDULE**  
 (To be attached to SF 1442)

BASE BID: All work required by the plans and specifications exclusive of work required by Option Bid Items.

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
0001	<u>General Instruction Building - Phase I</u> , complete, including utilities to the five-foot line; <u>excluding</u> all other work separately listed				
		Job	Sum	***	\$ _____
0002	<u>Central Energy Plant</u> , complete, including utilities to the five-foot line				
		Job	Sum	***	\$ _____
0003	<b>Drilled Piers</b>				
0003AA	18" Drilled Piers	355	VLF	\$ _____	\$ _____
0003AB	24" Drilled Piers	2,485	VLF	\$ _____	\$ _____
0003AC	30" Drilled Piers	1,953	VLF	\$ _____	\$ _____
0003AD	36" Drilled Piers	994	VLF	\$ _____	\$ _____
0003AE	42" Drilled Piers	534	VLF	\$ _____	\$ _____
0004	<b>Site Work</b> outside of the five-foot line, including utilities, sidewalks, paving, establishment of turf, and all other work not separately listed				
		Job	Sum	***	\$ _____

**TOTAL BASE BID** \$ \_\_\_\_\_

0005 OPTION NO. 1: Additional cost for all work required by the plans and specifications for demolition of underground utilities on the project site but not within the buildings' five-foot line.

**TOTAL OPTION NO. 1** \$ \_\_\_\_\_

0006 OPTION NO. 2: Additional cost for all work required by the plans and specifications for the construction of Support Avenue extension.

**TOTAL OPTION NO. 2** \$ \_\_\_\_\_

Solicitation No. DACA63-98-B-0040

BIDDING SCHEDULE (cont)

**0007 OPTION NO. 3a:** Additional cost for all work required by the plans and specifications for courtyard landscaping, benches, irrigation and irrigation control panel.

TOTAL OPTION NO. 3a \$ \_\_\_\_\_

**0008 OPTION NO. 3b:** Additional cost for all work required by the plans and specifications for landscaping adjacent to the building and south of the parade ground, benches, irrigation of trees, shrubs and turf shown within boundaries on the plan and irrigation control panel.

TOTAL OPTION NO. 3b \$ \_\_\_\_\_

**0009 OPTION NO. 3c:** Additional cost for all work required by the plans and specifications for irrigation of the parade ground and irrigation control panel.

TOTAL OPTION NO. 3c \$ \_\_\_\_\_

**0010 OPTION NO. 4:** Additional cost for all work required by the plans and specifications for the construction of brick screen wall around the exterior mechanical and electrical equipment and trash dumpsters.

TOTAL OPTION NO. 4 \$ \_\_\_\_\_

**0011 OPTION NO. 5:** Additional cost for all work required by the plans and specifications for southeast parking lot.

TOTAL OPTION NO. 5 \$ \_\_\_\_\_

TOTAL OPTION NOS. 1, 2, 3a, 3b, 3c, 4 and 5 \$ \_\_\_\_\_

TOTAL BID (BASE BID PLUS OPTIONS) \$ \_\_\_\_\_

[Am #1] **Reminder: All thirteen (13) Line Items ( 0001 thru 0013) on the Bidding Schedule stand alone. Bidders must bid on all thirteen (13) Line Items.**

**Solicitation No. DACA63-98-B-0040**

**BIDDING SCHEDULE (cont)**

NOTES:

1. ARITHMETIC DISCREPANCIES (EFARS 14.407-2)

(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.

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

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.

**Solicitation No. DACA63-98-B-0040**

**BIDDING SCHEDULE (cont)**

NOTES: (cont)

5. Responders are advised that this requirement may be delayed, cancelled 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 Forces.

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 optional items.

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).

8. OPTION FOR INCREASED QUANTITY - SEPARATELY PRICED LINE ITEM (MAR 1989)  
(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 60 calendar days after award of the Base Bid without an increase in the Offeror's Bid Price.

10. Supplemental Information - These items are for information only and must be prepared and submitted by all bidders within 48 hours after bid opening. Further explanation of the Tri-Service Cost Engineering System (TRACES) Work Breakdown Structure (WBS) is included in Note 11. The first two numerical digits of each item listed in the Supplemental Bidding Schedule below correspond to the Bid Item Number, the second two numerical digits to the TRACES WBS System Level, and the third two numerical digits to the TRACES WBS Subsystem Level. Listed Systems or Subsystems not applicable to this project should have a value of \$0.00 entered:

SUPPLEMENTAL BIDDING SCHEDULE

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
01	General Instruction Bldg; complete including all utilities to the five-foot line of the building				
01.01	SUBSTRUCTURE	JOB	SUM	***	\$_____
01.02	SUPERSTRUCTURE	JOB	SUM	***	\$_____
01.03	EXTERIOR CLOSURE	JOB	SUM	***	\$_____
01.04	ROOFING	JOB	SUM	***	\$_____
01.05	INTERIOR CONSTRUCTION	JOB	SUM	***	\$_____
01.06	FINISHES	JOB	SUM	***	\$_____
01.07	CONVEYING SYSTEMS	JOB	SUM	***	\$_____
01.08	PLUMBING	JOB	SUM	***	\$_____
01.09	HVAC	JOB	SUM	***	\$_____
01.10	FIRE PROTECTION SYSTEMS	JOB	SUM	***	\$_____
01.11	ELECTRICAL POWER & LIGHTING	JOB	SUM	***	\$_____
01.12	ELECTRICAL SYSTEMS	JOB	SUM	***	\$_____
01.13	EQUIPMENT	JOB	SUM	***	\$_____
01.14	FURNISHINGS	JOB	SUM	***	\$_____
01.15	SPECIAL CONSTRUCTION	JOB	SUM	***	\$_____
01.16	SELECTIVE BUILDING DEMOLITION	JOB	SUM	***	\$_____
	TOTAL (ITEMS 01.01 THRU 01.16)				\$_____

SUPPLEMENTAL BIDDING SCHEDULE (Cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
02	Central Energy Plant; complete including all utilities to the five-foot line of the building				
02.01	SUBSTRUCTURE	JOB	SUM	***	\$_____
02.02	SUPERSTRUCTURE	JOB	SUM	***	\$_____
02.03	EXTERIOR CLOSURE	JOB	SUM	***	\$_____
02.04	ROOFING	JOB	SUM	***	\$_____
02.05	INTERIOR CONSTRUCTION	JOB	SUM	***	\$_____
02.06	FINISHES	JOB	SUM	***	\$_____
02.07	CONVEYING SYSTEMS	JOB	SUM	***	\$_____
02.08	PLUMBING	JOB	SUM	***	\$_____
02.09	HVAC	JOB	SUM	***	\$_____
02.10	FIRE PROTECTION SYSTEMS	JOB	SUM	***	\$_____
02.11	ELECTRICAL POWER & LIGHTING	JOB	SUM	***	\$_____
02.12	ELECTRICAL SYSTEMS	JOB	SUM	***	\$_____
02.13	EQUIPMENT	JOB	SUM	***	\$_____
02.14	FURNISHINGS	JOB	SUM	***	\$_____
02.15	SPECIAL CONSTRUCTION	JOB	SUM	***	\$_____
02.16	SELECTIVE BUILDING DEMOLITION	JOB	SUM	***	\$_____
	TOTAL (ITEMS 02.01 THRU 02.16)				\$_____
03	Drilled Piers	JOB	SUM	***	\$_____

SUPPLEMENTAL BIDDING SCHEDULE (Cont)

Item No.	Description	Estimated Quantity	Unit	Unit Cost	Estimated Amount
<b>Sitework and Supporting Facilities: including all work outside the five-foot line of the building</b>					
<b>04.17</b>	<b>Site Preparation:</b>				
04.17.01	Site Clearing	Job	Sum	***	\$ _____
04.17.02	Site Demolition and Relocation	Job	Sum	***	\$ _____
04.17.03	Site Earthwork	Job	Sum	***	\$ _____
04.17.04	Site Cleanup	Job	Sum	***	\$ _____
04.17.91	Other Site Preparation	Job	Sum	***	\$ _____
<b>TOTAL (BID ITEM NOS. 04.17.01 through 04.17.91)</b>					<b>\$ _____</b>
<b>04.18</b>	<b>Site Improvements:</b>				
04.18.01	Roadways	Job	Sum	***	\$ _____
04.18.02	Parking Lots	Job	Sum	***	\$ _____
04.18.03	Walks, Steps, Ramps, and Terraces	Job	Sum	***	\$ _____
04.18.04	Site Development	Job	Sum	***	\$ _____
04.18.05	Landscaping	Job	Sum	***	\$ _____
04.18.06	Special Construction	Job	Sum	***	\$ _____
04.18.91	Other Site Improvement	Job	Sum	***	\$ _____
<b>TOTAL (BID ITEM NOS. 04.18.01 through 04.18.91)</b>					<b>\$ _____</b>
<b>04.19</b>	<b>Site Civil and Mechanical Utilities:</b>				
04.19.01	Water Supply and Distribution Systems	Job	Sum	***	\$ _____
04.19.02	Sanitary Sewer Systems	Job	Sum	***	\$ _____
04.19.03	Storm Sewer Systems	Job	Sum	***	\$ _____
04.19.04	Industrial Waste Systems	Job	Sum	***	\$ _____
04.19.05	Heating Distribution Systems	Job	Sum	***	\$ _____
04.19.06	Cooling Distribution Systems	Job	Sum	***	\$ _____
04.19.07	Natural and Propane Gas Distribution Systems	Job	Sum	***	\$ _____
04.19.08	Building Fuel Distribution Systems	Job	Sum	***	\$ _____
04.19.91	Other Civil and Mechanical Utilities	Job	Sum	***	\$ _____
<b>TOTAL (BID ITEM NOS. 04.19.01 through 04.19.91)</b>					<b>\$ _____</b>

ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-98-B-0040

Item No.	Description	Quantity	Unit	Unit Cost	Amount
<b>04.20</b>	<b>Site Electrical Utilities:</b>				
04.20.01	Substations	Job	Sum	***	\$ _____
04.20.02	Exterior Electrical Distribution	Job	Sum	***	\$ _____
04.20.03	Exterior Lighting	Job	Sum	***	\$ _____
04.20.04	Exterior Communications and Alarm Systems	Job	Sum	***	\$ _____
04.20.05	Exterior Security Sensors and TV Monitoring Systems	Job	Sum	***	\$ _____
04.20.06	Cathodic Protection	Job	Sum	***	\$ _____
04.20.91	Other Electrical Utilities	Job	Sum	***	\$ _____
<b>TOTAL (BID ITEM NOS. 04.20.01 through 04.20.91)</b>					<b>\$ _____</b>

SUPPLEMENTAL BIDDING SCHEDULE (cont)

11. Tri-Service Cost Engineering System (TRACES) Work Breakdown Structure (WBS) - The following information is supplied to the bidder for use in preparation of the required "Supplemental Bidding Schedule" [Units of Measure (UOM), are to be superseded by the Supplemental Bid Schedule units of measure.]:

<u>SYSTEM</u>	<u>SUB SYSTEM</u>	<u>UOM</u>	<u>TITLE</u>	<u>SYSTEM</u>	<u>SUB SYSTEM</u>	<u>UOM</u>	<u>TITLE</u>
				09	07	MBH	SYSTEMS TESTING AND BALANCING
01	SF		<b>SUBSTRUCTURE</b>	09	08	EA	SPECIAL MECHANICAL SYSTEMS
01	01	SF	STANDARD FOUNDATIONS				
01	02	SF	SPECIAL FOUNDATION CONDITIONS	10		SF	<b>FIRE PROTECTION SYSTEMS</b>
01	03	SF	SLAB ON GRADE	10	01	EA	WATER SUPPLY (FIRE PROTECTION)
01	04	CY	BASEMENT EXCAVATION	10	02	EA	SPRINKLERS
01	05	SF	BASEMENT WALLS	10	03	EA	STANDPIPE SYSTEMS
				10	04	EA	FIRE EXTINGUISHERS
				10	05	EA	SPECIAL FIRE PROTECTION SYSTEMS
02		SF	<b>SUPERSTRUCTURE</b>				
02	01	SF	FLOOR CONSTRUCTION	11		AMP	<b>ELECTRIC POWER &amp; LIGHTING</b>
02	02	SF	ROOF CONSTRUCTION	11	01	AMP	SERVICE AND DISTRIBUTION
02	03	SF	STAIR CONSTRUCTION	11	02	SF	LIGHTING AND BRANCH WIRING
03		SF	<b>EXTERIOR CLOSURE</b>				
03	01	SF	EXTERIOR WALLS	12		SF	<b>ELECTRICAL SYSTEMS</b>
03	02	SF	EXTERIOR WINDOWS	12	01	SF	COMMUNICATION, SECURITY, & ALARM SYSTEMS
03	03	EA	EXTERIOR PERSONNEL DOORS	12	02	SF	SPECIAL ELECTRICAL SYSTEMS
03	04	SF	EXTERIOR SPECIALTY DOORS				
				13		SF	<b>EQUIPMENT</b>
04		SF	<b>ROOFING</b>	13	01	SF	FIXED AND MOVEABLE EQUIPMENT
04	01	SF	ROOFING				
				14		SF	<b>FURNISHINGS</b>
05		SF	<b>INTERIOR CONSTRUCTION</b>	14	01	SF	FURNISHINGS
05	01	SF	PARTITIONS				
05	02	LEF	INTERIOR PERSONNEL DOORS	15		SF	<b>SPECIAL CONSTRUCTION</b>
05	03	SF	INTERIOR SPECIALTY DOORS	15	01	SF	VAULTS
05	04	SF	INTERIOR SPECIALTIES	15	02	SF	INTERIOR SWIMMING POOLS
05	05	SF	CASEWORK	15	03	SF	SPECIAL PURPOSE ROOMS
				15	04	SF	PRE-ENGINEERED BUILDINGS
06		SF	<b>INTERIOR FINISHES</b>	15	05	SF	WASHRACKS
06	01	SF	WALL FINISHES	15	06	SF	EXTERIOR UTILITY BUILDINGS
06	02	SF	FLOORING AND FLOOR FINISHES	15	9*	**	OTHER SPECIAL CONSTRUCTION
06	03	SF	CEILING AND CEILING FINISHES				
				16		LS	<b>SELECTIVE BUILDING DEMOLITION</b>
07		STY	<b>CONVEYING SYSTEMS</b>				
07	01	STP	ELEVATORS	16	01	LS	NON-HAZARDOUS SELECTIVE BUILDING DEMOLITION
07	02	LF	MOVING STAIRS AND WALKS				
07	03	EA	MATERIAL HANDLING SYSTEMS	16	02	LS	HAZARDOUS SELECTIVE BUILDING DEMOLITION
				16	9*	**	OTHER SELECTIVE BUILDING DEMOLITION
08		EA	<b>PLUMBING</b>				
08	01	EA	PLUMBING FIXTURES				
08	02	EA	DOMESTIC WATER SUPPLY				
08	03	EA	SANITARY WASTE AND VENT SYSTEM				
08	04	SF	RAINWATER DRAINAGE SYSTEM				
08	05	EA	PLUMBING EQUIPMENT				
08	06	EA	SPECIAL PLUMBING SYSTEMS				
							(SYSTEMS 17 through 20 continued below)
09		MBH	<b>HVAC</b>				
09	01	MBH	ENERGY SUPPLY				
09	02	MBH	HEAT GENERATING SYSTEMS				
09	03	TON	COOLING GENERATING SYSTEMS				
09	04	MBH	DISTRIBUTION SYSTEMS				
09	05	MBH	TERMINAL AND PACKAGE UNITS				
09	06	MBH	CONTROLS AND INSTRUMENTATION				

SUPPLEMENTAL BIDDING SCHEDULE (cont)

<u>SYSTEM</u>	<u>SUB SYSTEM</u>	<u>UOM</u>	<u>TITLE</u>
<b>17</b>		<b>AC</b>	<b>SITE PREPARATION</b>
17	01	AC	SITE CLEARING
17	02	SY	SITE DEMOLITION & RELOCATION
17	03	CY	SITE EARTHWORK
17	04	SY	SITE CLEANUP
17	9*	**	OTHER SITE PREPARATION
<b>18</b>		<b>SY</b>	<b>SITE IMPROVEMENTS</b>
18	01	SY	ROADWAYS
18	02	SPA	PARKING LOTS
18	03	SF	WALKS, STEPS, RAMPS, & TERRACES
18	04	EA	SITE DEVELOPMENT
18	05	SY	LANDSCAPING
18	06	EA	SPECIAL CONSTRUCTION
18	9*	**	OTHER SITE IMPROVEMENTS
<b>19</b>		<b>EA</b>	<b>SITE CIVIL &amp; MECHANICAL UTILITIES</b>
19	01	LF	WATER SUPPLY AND DISTRIBUTION SYSTEMS
19	02	LF	SANITARY SEWER SYSTEMS
19	03	LF	STORM SEWER SYSTEMS
19	04	LF	INDUSTRIAL WASTE SYSTEMS
19	05	LF	HEATING DISTRIBUTION SYSTEMS
19	06	LF	COOLING DISTRIBUTION SYSTEMS
19	07	LF	NATURAL AND PROPANE GAS DISTRIBUTION SYSTEMS
19	08	GAL	BUILDING FUEL DISTRIBUTION SYSTEMS
19	9*	**	OTHER SITE CIVIL & MECHANICAL UTILITIES
<b>20</b>		<b>EA</b>	<b>SITE ELECTRICAL UTILITIES</b>
20	01	KVA	SUBSTATIONS
20	02	LF	EXTERIOR ELECTRICAL DISTRIBUTION
20	03	SY	EXTERIOR LIGHTING
20	04	LF	EXTERIOR COMMUNICATIONS AND ALARM SYSTEMS
20	05	STA	EXTERIOR SECURITY SENSORS AND TV MONITORING SYSTEMS
20	06	LF	CATHODIC PROTECTION
20	9*	**	OTHER ELECTRICAL UTILITIES

SECTION 02575 - PAVEMENT REMOVAL

PART

1- GENERAL

1.1 SUMMARY

This section covers removal of existing concrete pavement and bituminous pavement, complete.

1.2 REFERENCES (Not Applicable)

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section \=01300=\ SUBMITTAL DESCRIPTIONS:

\\*SD-08 Statements\*\

\\*Work Plan\*\; \\*FIO\*\.

The Contractor shall furnish the proposed method for pavement removal and disposal.

1.4 Deleted AM#6

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REMOVAL OF BITUMINOUS PAVEMENT

Existing bituminous pavement shall be completely removed as necessary for construction of new paving, transitional areas, and for other construction operations requiring pavement removal. Edges of flexible pavement to be matched to new paving shall be cut smooth with pneumatic spades. All bituminous materials, binder, and aggregate shall be thoroughly removed. Any damage occurring to surfaces or pavements to remain, due to the Contractor's operations shall be repaired as directed at the expense of the Contractor. Removal shall be by approved methods and the materials removed shall be disposed of in the designated waste areas.

3.2 REMOVAL OF CONCRETE PAVEMENT

Existing concrete pavement shall be removed in the areas shown on the drawings. Pavement shall be removed in such a manner that no damage will occur in adjacent slabs. All concrete pavement to be removed where the limits of removal are not at existing joints, shall be scored to a depth of not less than 3 inches with a concrete saw or other similar equipment. Scoring shall be done in a straight line and shall be parallel to the existing joints where possible. Care shall be taken not to damage adjacent slabs. If adjacent slabs are damaged during removal operations, as determined by the Contracting Officer, the damaged portion shall be removed and replaced at the Contractor's expense and in a manner as

directed by the Contracting Officer. If cracks or overbreakage into adjacent concrete slabs occur during removal operations, the area within the scoring line shall be widened sufficiently to remove cracks or overbreakage, but if cracks or overbreakage fall within one foot of the next adjacent joint, the remainder of the slab adjacent to that joint shall be removed. During removal operations and after concrete has been removed, the Contractor shall exercise all precautions necessary to keep water from entering the subgrade. If water should enter the excavation, the Contractor shall remove the water by pumping and shall allow adequate time for the subgrade to dry, as determined by the Contracting Officer. Any slab or portion of slabs damaged due to negligence on the part of the Contractor shall be removed and replaced at his own expense. Pavement which is removed shall be disposed of in the designated waste areas.

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SECTION 03250

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

**PART 1. GENERAL**

**1.1.1. REFERENCES**

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 111 (1983) Inorganic Matter or Ash in Bituminous Materials

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 109 (1993) Steel, Strip, Carbon, Cold-Rolled

ASTM A 167 (1994a) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 480 (1995a) General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ASTM A 570 (1995) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM B 152 (1994) Copper Sheet, Strip, Plate, and Rolled Bar

ASTM B 370 (1992) Copper Sheet and Strip for Building Construction

ASTM C 919 (1984; R 1992) Standard Practice for Use of Sealants in Acoustical Applications

ASTM C 920 (1994) Elastomeric Joint Sealants

ASTM D 4 (1986; R 1993) Bitumen Content

ASTM D 6 (1980; R 1990) Loss on Heating of Oil and Asphaltic Compounds

ASTM D 412 (1992) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension

ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-98-B-0040

ASTM D 471 (1995) Rubber Property - Effect of Liquids

ASTM D 1190 (1994) Concrete Joint Sealer, Hot-Poured Elastic Type

ASTM D 1191 (1984; R 1994) Test Methods for Concrete Joint Sealers

ASTM D 1751 (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D 1752 (1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

[AMEND 6]  
~~ASTM D 1854 (1974; R 1990) Specification for Jet-Fuel Resistant Concrete Joint Sealer, Hot-Poured Elastic Type~~

ASTM D 1855 (1989) Test Method for Jet-Fuel Resistant Concrete Joint Sealer, Hot-Poured Elastic Type

ASTM D 2628 (1991) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

ASTM D 2835 (1989; R 1993) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements

ASTM D 5249 (1992) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

CORPS OF ENGINEERS (COE)

COE CRD-C 513 (1974) Corps of Engineers Specifications for Rubber Waterstops

COE CRD-C 572 (1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops

**1..2. SUBMITTALS**

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data  
Preformed Expansion Joint Filler; FIO.  
Sealant; FIO.  
Waterstops; FIO.  
Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers

(when required by sealant manufacturer); preformed compression seals; and waterstops.

**SD-04 Drawings**

Waterstops; FIO.

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

**SD-06 Instructions**

Preformed Expansion Joint Filler; FIO.

Sealant; FIO.

Waterstops; FIO.

Manufacturer's recommended instructions for installing preformed fillers, field-molded sealants; preformed compression seals; and waterstops; and for splicing non-metallic waterstops.

**SD-13 Certificates**

Preformed Expansion Joint Filler; FIO.

Sealant; FIO.

Waterstops; FIO.

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

**SD-14 Samples**

Preformed Compression Seals and Lubricants; FIO.

Specimens identified to indicate the manufacturer, type of material, size and quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 9 ft of 1 inch nominal width or wider seal or a piece not less than 12 ft of compression seal less than 1 inch nominal width. One quart of lubricant shall be provided.

Field-Molded Sealant and Primer; FIO.

One gallon of field-molded sealant and one quart of primer (when primer is recommended by the sealant manufacturer) identified to indicate manufacturer, type of material, quantity, and shipment or lot represented.

Non-metallic Waterstops and Splices; FIO.

Specimens identified to indicate manufacturer, type of material, size, quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 12 inch long cut from each 200 ft of finished waterstop furnished, but not less than a total of 4 ft of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site. The splice samples shall be made using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each splice shall be not less than 12 inches long.

**1.1.3. DELIVERY AND STORAGE**

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

**PART 2. PRODUCTS**

**2.1.1. CONTRACTION JOINT STRIPS**

Contraction joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

**2..2. PREFORMED EXPANSION JOINT FILLER**

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 3/8 inch thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249 .

**2..3. SEALANT**

Joint sealant shall conform to the following:

**2..3..1. Preformed Polychloroprene Elastomeric Type**

ASTM D 2628.

**2..3..2. Lubricant for Preformed Compression Seals**

ASTM D 2835.

**2..3..3. Hot-Poured Type**

ASTM D 1190 tested in accordance with ASTM D 1191.

**2..3..4. Field Molded Type**

ASTM C 920, Type M for horizontal joints or Type NS for vertical joints, Class 25, and Use NT. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

[AMEND 6]

~~**2..3..5. Hot-Applied Jet-Fuel Resistant Type**~~

~~ASTM D 1854 tested in accordance with ASTM D 1855.~~

**2..4. WATERSTOPS**

Intersection and change of direction waterstops shall be shop fabricated.

[AMEND 6]

~~**2..4..1. Flexible Metal**~~

~~Copper waterstops shall conform to ASTM B 152 and ASTM B 370, O60 soft anneal temper and 20 oz mass per sq ft sheet thickness. Stainless steel waterstops shall conform to ASTM A 167 and ASTM A 480, UNS S30453 (Type 304L), and 20 gauge thick strip.~~

~~**2..4..2. Rigid Metal**~~

~~Flat steel waterstops shall conform to ASTM A 109, No. 2 (half hard) temper, No. 2 edge, No. 1 (matte or dull) finish or ASTM A 570, Grade 40.~~

**2..4..3. Non-Metallic**

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

**2..4..4. Non-Metallic Hydrophilic**

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D 412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 70 degrees F shall be 3 to 1 minimum.

**2..4..5. Preformed Elastic Adhesive**

Preformed plastic adhesive waterstops shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, and shall contain no solvents, asbestos, irritating fumes or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength.

**2..4..5..1. Chemical Composition**

The chemical composition of the sealing compound shall meet the requirements shown below.

COMPONENT	TEST	PERCENT BY WEIGHT	
		MIN.	MAX.
Bitumen (Hydrocarbon plastic)	ASTM D 4	50	70
Inert Mineral Filler	AASHTO T 111	30	50
Volatile Matter	ASTM D 6	--	2

**2..4..5..2. Adhesion Under Hydrostatic Pressure**

The sealing compound shall not leak at the joints for a period of 24 hours under a vertical 6 foot head pressure. In a separate test, the sealing compound shall not leak under a horizontal pressure of 10 psi which is reached by slowly applying increments of 2 psi every minute.

**2..4..5..3. Sag of Flow Resistance**

No sagging shall be detected when tested as follows: Fill a wooden form 1 inch wide and 6 inches long flush with sealing compound and place in an oven at 135 degrees F in a vertical position for 5 days.

**2..4..5..4. Chemical Resistance**

The sealing compound when immersed separately in a 5% solution of caustic potash, a 5% solution of hydrochloric acid, 5% solution of sulfuric acid and a saturated hydrogen sulfide solution for 30 days at ambient room temperature shall show no visible deterioration.

### **PART 3. EXECUTION**

#### **3.1. JOINTS**

Joints shall be installed at locations indicated and as authorized.

##### **3.1.1. Contraction Joints**

[AMEND 6]

<&AST>

~~NOTE: Since contraction joint strips are difficult to align and maintain in alignment, the option for use of joint strips should be deleted where appearance is important or where concrete slabs will not be covered with subsequent toppings that will hide the joint.~~

<&AST>

~~Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately  $3\text{ mm}$   $\sim 1/8$  inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than  $25\text{ mm}$   $\sim 1$  inch.~~

##### **3.1.1.1. Joint Strips**

~~Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. Means shall be provided to insure true alignment of the strips is maintained during insertion.~~

##### **3.1.1.2. Sawed Joints**

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in sequence of concrete placement. Sludge and cutting debris shall be removed.

##### **3.1.2. Expansion Joints**

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 1/8 inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top thereof to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

**3..1..3. Joint Sealant**

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

**3..1..3..1. Joints With Preformed Compression Seals**

Compression seals shall be installed with equipment capable of installing joint seals to the prescribed depth without cutting, nicking, twisting, or otherwise distorting or damaging the seal or concrete and with no more than 5 percent stretching of the seal. The sides of the joint and, if necessary, the sides of the compression seal shall be covered with a coating of lubricant. Butt joints shall be coated with liberal applications of lubricant.

**3..1..3..2. Joints With Field-Molded Sealant**

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 40 degrees F. When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed. Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

**3..2. WATERSTOPS, INSTALLATION AND SPLICES**

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

[AMEND 6]

~~3..2..1. Copper And Stainless Steel~~

~~Splices in copper waterstops shall be lap joints made by brazing. Splices in stainless steel waterstops shall be welded using a TIG or MIG process utilizing a weld rod to match the stainless. All welds shall be annealed to maintain physical properties. No carbon flame shall be used in the annealing process. Damaged waterstops shall be repaired by removing damaged portions and patching. Patches shall overlap a minimum of 1 inch onto undamaged portion of the waterstop.~~

~~3..2..2. Flat Steel~~

~~Splices in flat steel waterstops shall be properly aligned, butt welded, and cleaned of excessive material.~~

**3..2..3. Non-Metallic**

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

**3..2..3..1. Rubber Waterstop**

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

**3..2..3..2. Polyvinyl Chloride Waterstop**

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

**3..2..3..3. Quality Assurance**

Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 1/16 inch. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 1/16 inch or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 1/2 inch in 10 feet. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

**3..2..4. Non-Metallic Hydrophilic Waterstop Installation**

Ends to be joined shall be miter cut with sharp knife or shears. The ends shall be adhered with cyanacrylate (super glue) adhesive. When joining hydrophilic type waterstop to PVC waterstop, the hydrophilic waterstop shall be positioned as shown on the drawings. A liberal amount of a single component hydrophilic sealant shall be applied to the junction to complete the transition.

**3..2..5. Preformed Plastic Adhesive Installation**

The installation of preformed plastic adhesive waterstops shall be a prime, peel, place and pour procedure. Joint surfaces shall be clean and dry before priming and just prior to placing the sealing strips. The end of each strip shall be spliced to the next strip with a 1 inch overlap; the overlap shall be pressed firmly to release trapped air. During damp or cold conditions the joint surface shall be flashed with a safe, direct flame to warm and dry the surface adequately; the sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.

**3..3. CONSTRUCTION JOINTS**

Construction joints are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

END

SECTION 04255

NONBEARING MASONRY VENEER/STEEL STUD WALLS

07/92

**PART**

**1 GENERAL**

**1.1 REFERENCES**

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

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

\-AISC M016-\ (1989) Manual of Steel Construction Allowable Stress Design

AMERICAN IRON AND STEEL INSTITUTE (AISI)

\-AISI SG-671-\ (1986; Addenda 1989; Errata Nov 30, 1990) Specification for the Design of Cold-Formed Steel Structural Members (Part I of the Cold-Formed Steel Design Manual)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 36-\ (1994) Carbon Structural Steel

\-ASTM A 82-\ (1995a) Steel Wire, Plain, for Concrete Reinforcement

\-ASTM A 123-\ (1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

\-ASTM A 153-\ (1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

\-ASTM A 653-\ (1995) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

\-ASTM C 79-\ (1994) Gypsum Sheathing Board

\-ASTM C 90-\ (1995) Load-Bearing Concrete Masonry Units

\-ASTM C 91-\ (1995) Masonry Cement

\-ASTM C 216-\ (1995) Facing Brick (Solid Masonry Units Made from Clay or Shale)

\-ASTM C 270-\ (1995a) Mortar for Unit Masonry

ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-98-B-0040

- \-ASTM C 494-\ (1992) Chemical Admixtures for Concrete
- \-ASTM C 578-\ (1995) Rigid, Cellular Polystyrene Thermal Insulation
- \-ASTM C 591-\ (1994) Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation
- \-ASTM C 665-\ (1994) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
- \-ASTM C 744-\ (1995) Prefaced Concrete and Calcium Silicate Masonry Units
- \-ASTM C 780-\ (1994) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
- \-ASTM C 954-\ (1993) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
- \-ASTM C 955-\ (1995) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases
- \-ASTM C 1002-\ (1993) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases
- \-ASTM C 1072-\ (1994) Measurement of Masonry Flexural Bond Strength

[AM#1]

- \-ASTM D 226-\ (1994) Asphalt Saturated Organic felt Used in Roofing and Waterproofing
- \-ASTM D 1056-\ (1991) Flexible Cellular Materials - Sponge or Expanded Rubber
- \-ASTM D 1330-\ (1985; R 1990) Rubber Sheet Gaskets
- \-ASTM D 1667-\ (1976; R 1990) Flexible Cellular Materials - Vinyl Chlorine Polymers and Copolymers (Closed-Cell Foam)
- \-ASTM D 2103-\ (1992) Polyethylene Film and Sheeting
- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING (ASHRAE)
- \-ASHRAE 81930-\ (1993) Handbook, Fundamentals I-P Edition
- AMERICAN WELDING SOCIETY (AWS)

\-AWS D1.3-\ (1989) Structural Welding Code - Sheet Steel

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

\\*SD-01 Data\

\\*Masonry Veneer/Steel Stud Wall System\; \\*FIO\.

Calculations or tabular data as necessary, demonstrating the structural performance of the cold-formed steel framing system for the specified loadings and deflection criteria in accordance with the provisions of AISI S100. Calculations demonstrating the structural adequacy of steel lintels and shelf angles for the calculated gravity loadings being supported. This analysis shall be in accordance with AISC 360. Test results demonstrating that the veneer anchors are structurally adequate to resist the specified loadings shall be submitted for approval.

Calculations demonstrating the insulation shown on the Detail Drawings provides the specified U-value for heat transmission of the completed exterior wall construction shall be submitted for approval. This analysis shall be in accordance with ASHRAE 90.1. Manufacturer's descriptive data and installation instructions for the insulation, the vapor barrier and the moisture barrier.

\\*SD-04 Drawings\

\\*Masonry Veneer/Steel Stud Wall System\; \\*FIO\.

Details of cold-formed steel framing and support around openings, including framing connections, steel lintels, steel shelf angles, attachment to other building elements and bridging. Drawings shall indicate thickness, material, dimensions, protective coatings, and section properties of all steel studs and other cold-formed steel framing members and of all steel lintels and shelf angles used in exterior wall framing. Drawings shall also indicate size and type of all fasteners including size and type of all welds.

\\*SD-14 Samples\

\\*Expansion Joint Materials\; \\*FIO\.

\\*Brick\; \\*FIO\.

\\*Sample Panel\; \\*FIO\.

A portable panel, approximately 2 by 2 feet, containing approximately 24 brick facings to establish the range of color and texture. One of each type of masonry veneer anchor used.

\\*SD-13 Certificates\

\\*Brick\*\; \\*FIO\*\.

\\*Joint Reinforcement\*\; \\*FIO\*\.

\\*Expansion Joint Materials\*\; \\*FIO\*\.

\\*Insulation\*\; \\*FIO\*\.

\\*Gypsum Sheathing\*\; \\*FIO\*\.

\\*Moisture Barrier\*\; \\*FIO\*\.

\\*Vapor Barrier\*\; \\*FIO\*\.

\\*Veneer Anchors\*\; \\*FIO\*\.

\\*Welders Qualification\*\; \\*FIO\*\.

Certificates stating that the materials and welders meet the requirements herein specified. Each certificate shall be signed by an authorized certification official and shall include their organization and position and shall identify the products covered under their certifying signature.

### 1.3 SAMPLE PANEL

After the material samples are approved and prior to starting masonry work, a sample masonry panel shall be built on the project site where directed. The sample panel shall be not less than ~6 feet~ long by ~4 feet~ high. The panel shall be of typical wall thickness for the construction represented. The panel shall show color range, texture, bond pattern, expansion joints, and cleaning of the masonry as required in the work. The panel shall also show cold-formed steel framing, insulation, gypsum wallboard, gypsum sheathing, moisture barrier, vapor barrier, veneer anchors, joint reinforcement, steel shelf angles, flashing and weep holes. The approved sample panel shall be used as a standard of workmanship required in the actual installation. The sample panel shall be protected from weather and construction operations and shall not be removed until the masonry veneer/steel stud wall work has been completed and accepted.

### 1.4 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled in a manner to avoid chipping, breakage, bending or other damage and to avoid contact with soil or other contaminating materials. The masonry products shall be stored off the ground and protected from inclement weather. Cementitious materials shall be delivered in unopened containers plainly marked and labeled with manufacturer's names and brands. Cementitious materials shall be stored in dry, weather-tight enclosures or covers. Sand and other aggregates shall be stored in a manner to prevent contamination or segregation and under a weather-tight covering permitting good air circulation. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust. Insulation, moisture barrier, and gypsum sheathing shall be stored in dry, well ventilated, weather-tight areas protected from sunlight and excessive heat. Air infiltration type vapor barrier shall be stored in accordance with the manufacturer's recommendations.

## **1.5 EFFLORESCENCE TESTS**

Efflorescence tests shall be performed as indicated in SECTION 04200 - MASONRY.

## **PART 2 PRODUCTS**

### **2.1 VENEER WYTHE**

#### **2.1.1 Clay or Shale Brick**

Clay or shale brick veneer shall be as specified in SECTION 04200 - MASONRY.

#### **2.1.2 Cast Stone**

Cast Stone shall be as specified in SECTION: 04735 CAST STONE.

### **2.2 MORTAR**

Mortar shall conform to \-ASTM C 270-\, Type S. Mortar mix shall be based on proportion specifications. Laboratory testing of mortar shall be in accordance with the preconstruction evaluation of mortar section of \-ASTM C 780-\. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

#### **2.2.1 Masonry Cement**

Masonry cement in conformance with \-ASTM C 91-\ may be used in the mortar. When using a masonry cement a comparative test will be performed between a portland cement-lime mortar and the masonry cement mortar proposed for the project to evaluate the \-ASTM C 1072-\ bond and the \-ASTM C 780-\compressive strength of the two mixes. The test shall be conducted with the proposed masonry units for the project. The masonry cement mortar will be acceptable if the bond and compressive strength values are equal to or higher than the portland cement-lime mix. The air-content of the masonry cement shall be limited to 12 percent maximum.

#### **2.2.2 Admixtures**

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

### **2.3 JOINT REINFORCEMENT**

Joint reinforcement shall be of steel wire conforming to \-ASTM A 82-\. Fabrication shall be by welding. Tack welding will not be permitted. Reinforcement shall be zinc-coated after fabrication in accordance with \-ASTM A 153-\, Class B-2. Joint reinforcement shall consist of at least 1 continuous longitudinal wire in the veneer wythe. Minimum wire cross section shall be \~0.017 square inches.\

### **2.4 COLD-FORMED STEEL FRAMING**

Cold-formed framing shall consist of steel studs, top and bottom tracks, runners, horizontal bridging, and other cold-formed members and other accessories. The cold-formed framing system shall be designed in accordance with \-AISI SG-671-\ . The steel studs and other cold-formed steel framing members within the wall shall be designed to resist the entire wind and seismic loadings acting inward and outward perpendicular to the wall system without exceeding a deflection of 1/600 times the vertical stud span and \-AISI SG-671-\ allowable stresses. To prevent the masonry wythe from cracking due to "hard spot" support at doors, windows, and other openings, the completed design of the cold-formed steel system shall result in bending stiffnesses and deflections at openings that are compatible with those away from wall openings. Design calculations shall be submitted for approval. All members and components made of sheet steel shall be hot-dip galvanized in accordance with \-ASTM A 653-\ with a minimum coating thickness of G 60. Framing covered herein shall be used only in framing the exterior masonry veneer steel stud wall system as indicated on the drawings. Metal framing for interior partitions are specified in Section \=09250=\ GYPSUM WALLBOARD.

#### **2.4.1 Steel Studs**

Studs shall conform to \-ASTM A 653-\, Grade 33, having a minimum yield strength of  $\sqrt{33,000}$  psi. Studs shall be cold-formed from .0598 (16ga) inches minimum base metal thickness steel except where noted otherwise on the construction drawings [AM#1] and spaced at 16-inches on center. Studs shall be 6 inches deep and shall have a minimum flange width of 1.625 inches with a minimum return lip of .625 inches. Section properties shall be determined in accordance with AISI SG-671.

#### **2.4.2 Runners, Tracks, Bridging and Accessories**

All cold-formed steel sheet framing members, components, and accessories, other than the steel studs, shall conform to \-ASTM C 955-\ and be of steel conforming to \-ASTM A 653-\, Grade 33, having a minimum yield strength of 33,000 psi.

### **2.5 INSULATION**

#### **2.5.1 Blanket Insulation**

[AM#6]

Insulation placed between the steel studs shall be batt or blanket type mineral wool conforming to \-ASTM C 665-\, Type III, with an R-21 value.

#### **2.6 GYPSUM WALLBOARD**

Gypsum wallboard that is installed on the interior side of the cold-formed steel framing system shall be as specified in Section \=09250=\ GYPSUM WALLBOARD.

#### **2.7 EXTERIOR SHEATHING**

[AM#6]

Gypsum sheathing that is installed on the exterior side of the cold-formed steel framing system shall have a minimum thickness of  $\sim\frac{5}{8}$  inch $\sim$  and shall be  $\sim 4$  feet $\sim$  wide. Gypsum sheathing shall conform to  $\sim$ ASTM C 79 $\sim$ . Gypsum sheathing shall have a water-resistant gypsum core with a water-repellent paper firmly bonded to the core.

## **2.8 MOISTURE PROTECTION**

### **2.8.1 Moisture Barrier**

The moisture barrier shall be  $\sim 15$ -lb $\sim$  asphalt-saturated felt conforming to  $\sim$ ASTM D 226 $\sim$  Type I (No. 15).

### **2.8.2 Vapor Retarder**

The vapor retarder shall be polyethylene film conforming to  $\sim$ ASTM D 2103 $\sim$ ,  $\sim 6$  mil $\sim$  minimum thickness.

### **2.8.3 Staples**

Staples for attaching the moisture barrier to the exterior sheathing shall be the type and size best suited to provide a secure connection. Staples shall be made from either galvanized steel or stainless steel wire.

### **2.8.4 Joint Tape**

Tape for sealing the joints in the vapor retarder shall be laminated tape with pressure sensitive adhesive as recommended by the manufacturer of the polyethylene film.

## **2.9 VENEER ANCHORS**

Anchor assemblies for the attachment of the masonry veneer to the cold-formed steel framing, structural steel and/or concrete beam and column members, and concrete floor slabs will be designed for the design loadings shown. Anchors will transfer the design loadings from the masonry veneer to the cold-formed steel framing system or other support without exceeding the allowable stresses and deflections in the anchors. Length of anchor wires shall be such that the outermost wires lie between  $\sim 1\frac{1}{4}$  inch $\sim$  from each face of the masonry veneer. Anchor wires shall not have drips. Wires for veneer anchors shall be rectangular or triangular hoops formed from  $\sim\frac{3}{16}$  inch $\sim$  diameter steel wire conforming to  $\sim$ ASTM A 82 $\sim$ . Anchor assemblies including wires and anchor plates shall be hot-dip galvanized conforming to  $\sim$ ASTM A 153 $\sim$ , Class B-2. The veneer anchor shall have a minimum capacity of 200 pounds. The load-displacement capacity of each veneer anchor, both in direct pull-out for tension and compression, shall not be less than  $\sim 2000$  pounds per inch $\sim$  (or a deflection of  $\sim 0.05$  inches per 100 pounds $\sim$  of load in tension or compression). In the direction perpendicular to the masonry veneer, the anchor assembly shall have a maximum play of  $\sim\frac{1}{16}$  inch $\sim$ .

### **2.9.1 Adjustable Pintle-Eye Type Wire Anchors**

Adjustable pintle-eye type wall anchors shall be two pieces rectangular type double pintle anchors.

## 2.10 CONNECTIONS

Screws, bolts and anchors shall be hot-dip galvanized in accordance with \-ASTM A 123-\ or \-ASTM A 153-\ as appropriate.

### 2.10.1 Framing Screws, Bolts and Anchors

Screws, bolts and anchors used in the assembly of the cold-formed steel framing system shall be as required by design of the framing system for the specified loading. Screw, bolt and anchor sizes shall be shown on the detail drawings.

### 2.10.2 Welding

All welded connections shall be designed and all welding shall be performed in accordance with \-AWS D1.3-\, as modified by \-AISI SG-671-\.. All welders shall be qualified in accordance with \-AWS D1.3-\.. All welds shall be cleaned and touched-up with zinc-rich paint.

### 2.10.3 Veneer Anchor Screws

[AM#1]

Screws for attachment of the veneer anchors to the cold-formed steel framing members shall be as required by design to provide the needed pullout load capacity but not less than No. 12. Screws shall be galvanized or stainless steel. The length of screws shall be such that the screws penetrate the holding member by not less than  $\sim 5/8$  inch.~\

### 2.10.4 Gypsum Sheathing Screws

[AM#1]

Screws for attachment of gypsum sheathing to cold-formed steel framing shall \_\_\_\_\_ be galvanized.

## 2.11 SYNTHETIC RUBBER WASHERS

Synthetic rubber washers for placement between veneer anchors and the moisture barrier on the outside face of the exterior sheathing shall conform to \-ASTM D 1330-\, Grade I.

## 2.12 EXPANSION JOINT MATERIAL

Expansion joint materials shall be bellows or U-shaped type conforming to \=05500=\ MISCELLANEOUS METALS. Premolded type shall be closed-cell cellular rubber conforming to \-ASTM D 1056-\ or closed-cell vinyl or polyvinyl chloride conforming to \-ASTM D 1667-\.

## 2.13 FLASHING

Copper or stainless steel flashing shall conform to the requirements in Section \=07600=\ SHEET METALWORK, GENERAL. Flashing shall be supplied in a continuous sheet extending from the exterior sheathing across the cavity and through the masonry veneer as shown.

## 2.14 STEEL LINTELS AND SHELF ANGLES

Steel shapes used for lintels and shelf angles shall conform to \-ASTM A 36-\ . Lintels and shelf angles shall be provided as shown. These steel members shall be hot-dip galvanized in accordance with \-ASTM A 123-\ .

### **2.15 CAULKING AND SEALANTS**

Caulking and sealants shall be as specified in Section \=07920=\ JOINT SEALING.

[AM#1]

### **2.16 MORTAR COLLECTION DEVICE**

Mortar 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 shall allow water and air to move through the device to the weepholes.

## **PART 3 EXECUTION**

### **3.1 GENERAL INSTALLATION REQUIREMENTS**

Wall sections, types of construction and dimensions shall be as shown. Metal door and window frames and other special framing shall be built and anchored into the wall system as indicated.

### **3.2 STEEL STUD WALL FRAMING**

The top track of the stud wall system shall be slip jointed to accommodate vertical deflections of the supporting members as shown on the drawings, where studs are placed under steel beams. Top and bottom tracks shall be securely anchored to resist track rotation by alternating fastener locations to provide two rows, one row near each track flange as shown on the drawings. Both flanges of all steel studs shall be securely fastened with screws to the flanges of the top and bottom tracks as shown on the drawings. All details for affixing steel studs to runners and all other sheet steel framing members along with all details necessary for anchorage of the steel stud wall system to the building structural systems shall be shown on the drawings. Horizontal bridging shall be provided as necessary. Stud spacing shall be as required to resist the specified design wind or seismic loadings, but not exceeding \~ 16 inches~\ on center. Unless noted otherwise on plans coordinate stud spacing with sheathing and anchor requirements. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door openings. Door frames and other built-in items shall be grouted solid.

### **3.3 STEEL SHELF ANGLES**

Unless otherwise shown, steel shelf angles shall be provided in segments that do not exceed \~10 feet~\ in length. At building corners, shelf angle segments shall be mitered and securely attached together by welding with legs no less than \~4 feet~\ where possible. Elsewhere, shelf angle segments shall not be connected together but instead shall be installed

with  $\sim 1/4$  inch wide gaps between the segments. Fabrication and erection tolerances shall be in accordance with the AISC Code of Standard Practice, as indicated in  $\sim$ AISC-03 $\sim$ .

### **3.4 INSULATION**

The actual installed thickness of insulation shall provide a maximum thermal R of 19 as determined in accordance with  $\sim$ ASHRAE-03 $\sim$ . Insulation thickness shall be as shown on the approved drawings. Installation, except as otherwise specified or shown, shall be in accordance with the manufacturer's instructions which shall be approved by the Contracting Officer. Insulation shall be installed between wall framing members. Rigid insulation shall be installed in accordance with the manufacturer's instructions with proper connections through the insulation to prevent the insulation from carrying loads directly. Insulation with facings shall be secured to the sides of the framing members to provide a continuous seal and so that the entire weight of the insulation is carried by the framing members. Where electrical outlets, ducts, pipes, vents or other utility items occur, insulation shall be placed on the dry side of the item away from excessive humidity.

### **3.5 GYPSUM WALLBOARD**

Gypsum wallboard shall be installed on the interior face of the cold-formed steel framing system. Installation shall be as specified in Section  $\sim$ 09250 $\sim$  GYPSUM WALLBOARD except at vertical slip joints, the gypsum wallboard shall be connected to the vertical studs only so as not to prevent movement at the slip joint.

### **3.6 EXTERIOR SHEATHING**

Sheathing shall be installed on the exterior face of the cold-formed steel framing system with self-drilling screws. Screws shall be located a minimum of  $\sim 3/8$  inch from the ends and edges of sheathing panels and shall be spaced not more than  $\sim 8$  inches on each supporting member except at vertical slip joints, the sheathing should be connected to the vertical studs only so as not to prevent movement of the slip joint. Edges and ends of gypsum sheathing panels shall be butted snugly with vertical joints staggered to provide full and even support for the moisture barrier. All holes and gaps resulting from abandoned screw installations, from damage to panels, and from cutting and fitting of panels at junctures with doors, windows, foundation walls, floor slabs and other similar locations shall be filled with exterior rubber-base caulk.

### **3.7 MOISTURE PROTECTION**

#### **3.7.1 Moisture Barrier**

The asphalt-saturated felt or other approved moisture barrier shall be installed on the outer face of the exterior sheathing. The moisture barrier shall be installed horizontally and shingled with each sheet lapped not less than  $\sim 6$  inches over the sheet below. Vertical end joints shall be lapped not less than  $\sim 6$  inches and shall be staggered. Attachment of the moisture barrier shall be with staples spaced not greater than  $\sim 16$  inches on center or as required by the manufacturer.

### 3.7.2 Vapor Retarder

[AM#1]

A vapor retarder shall be installed. The vapor retarder shall be installed on the interior surface \_\_\_\_\_ to form a complete retarder to vapor infiltration on all exterior walls of Areas B, C, D, E, and F. The joints shall be lapped and sealed with tape.

### 3.8 VENEER ANCHORS

Veneer anchors shall be attached with screws through the sheathing and rigid insulation to the steel studs or other support members at the locations shown. When rigid insulation is used, the method of connecting the veneer anchor through the insulation shall be approved by the Contracting Officer. Veneer anchors shall be installed with the outermost wires lying between  $\sim 5/8$  inch $\sim$  from each face of the masonry veneer. Synthetic rubber washers shall be used between the anchor connector plates and the moisture barrier. A clutch torque slip screw gun shall be used on screws attaching veneer anchors to cold-formed steel members. Veneer anchors with corrugated sheet metal or wire mesh members extending across the wall cavity shall not be used. There shall be one veneer anchor for each  $\sim$ two square feet $\sim$  of wall and shall be attached to steel studs and other supports with a maximum spacing of  $\sim 24$  inches $\sim$  on center. For pintle-eye anchors the vertical distance between the pintle section horizontal wires and the eye section horizontal wires shall not exceed  $\sim 1/2$  inch $\sim$ .

### 3.9 FLASHING

Continuous flashing shall be provided at the bottom of the wall cavity just above grade. Flashing shall also be provided above and below openings at lintels and sills, at shelf angles, and at other location as indicated on the drawings. Flashing shall be as detailed and as specified in Section  $\text{\textasciitilde}07600\text{\textasciitilde}$  SHEET METALWORK, GENERAL. Flashing shall be lapped a minimum of  $\sim 6$  inches $\sim$  at joints and shall be sealed with a mastic as recommended by the flashing manufacturer. Ends over doors, windows and openings shall be turned up and secured. Flashing shall be lapped under the moisture barrier a minimum of  $\sim 6$  inches $\sim$  and securely attached to the gypsum sheathing. Flashing shall extend through the exterior face of the masonry veneer and turned down to form a drip.

### 3.10 MASONRY VENEER

Exterior masonry wythes shall be constructed to the thickness indicated on the drawings. A cavity consisting of a width indicated on the drawings  $\sim [2] [ \text{_____} ]$  inch $\sim$  minimum width air space will be provided between the moisture barrier and the masonry veneer. Masonry veneer will not be installed until the exterior sheathing, moisture barrier, veneer anchors and flashing have been installed on the cold-formed steel framing system. Extreme care shall be taken to avoid damage to the moisture barrier and flashing during construction of the masonry veneer. Any portion of the moisture barrier and flashing that is damaged shall be repaired or replaced prior to completion of the veneer. Masonry shall be placed in running bond pattern. Vertical joints on alternating courses shall be aligned and kept vertically plumb. Solid masonry units shall be laid in a non-furrowed full bed of mortar, beveled and sloped toward the center of the wythe on which the mortar is placed. Units shall be shoved into place so that the

vertical mortar joints are completely full and tight. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned and relaid. Mortar which protrudes more than  $\sim 1/2$  inch into the cavity space shall be removed. Means shall be provided to ensure that the cavity space is kept clean of mortar droppings and other loose debris. Chases and raked-out joints shall be kept free from mortar and debris. Faces of units used in finished exposed areas shall be free from chipped edges, material texture or color defects or other imperfections distracting from the appearance of the finished work.

#### **3.10.1 Surface Preparation**

Surfaces on which masonry is to be laid shall be cleaned of laitance or other foreign material. No units having a film of water shall be laid.

#### **3.10.2 Hot Weather Construction**

Temperatures of masonry units and mortar shall not be greater than  $\sim 120$  degrees F when laid. Masonry erected when the ambient air temperature is more than  $\sim 99$  degrees F in the shade and when the relative humidity is less than 50 percent shall be given protection from the direct exposure to wind and sun for 48 hours after the installation.

#### **3.10.3 Cold Weather Construction**

Temperatures of masonry units and mortar shall not be less than  $\sim 40$  degrees F when laid. When the ambient air temperature is  $\sim 32$  degrees F or less, masonry veneer under construction shall be protected and maintained at a temperature greater than  $\sim 32$  degrees F for a period of 48 hours after installation. The proposed method of maintaining the temperature within the specified range shall be submitted for approval prior to implementation. No units shall be laid on a surface having a film of frost or water.

#### **3.10.4 Tolerances**

Masonry shall be laid plumb, level and true to line within the tolerances specified in TABLE 1. All masonry corners shall be square unless otherwise indicated on the drawings.

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TABLE I

Variation From Plumb

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In adjacent units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variation From Level Or Grades

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In 10 feet	1/8 inch
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variation From Linear Building Lines

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In 20 feet	1/2 inch
In 40 feet or more	3/4 inch

Variation From Cross Sectional Dimensions Of Walls

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Plus	1/2 inch
Minus	1/4 inch~\

**3.10.5 Mixing of 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. Measurement of sand shall be accomplished by the use of a container of known capacity or shovel count based on a container of known capacity. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of the 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 shall be discarded.

**3.10.6 Cutting and Fitting**

Wherever possible, full units shall be used in lieu of cut units. Where cut units are required to accommodate the design, cutting shall be done by masonry mechanics using power masonry saws. Wet-cut units shall be dried to the same surface-dry appearances of uncut units before being placed in the work. Cut edges shall be clean, true and sharp. Openings to accommodate pipes, conduits, and other accessories shall be neatly formed so that framing or escutcheons required will completely conceal the cut edges. Insofar as practicable, all cutting and fitting shall be accomplished while masonry work is being erected.

**3.10.7 Masonry Units**

When being laid, masonry units shall have suction sufficient to hold the mortar and to absorb water from the mortar, but shall be damp enough to allow the mortar to remain in a plastic state to permit the unit to be leveled and plumbed immediately after being laid without destroying bond. Masonry units with frogging shall be laid with the frog side down and better or face side exposed to view. Masonry units that are cored, recessed or otherwise deformed may be used in sills or in other areas except where deformations will be exposed to view.

### **3.10.8 Mortar Joints**

Mortar joint widths shall be uniform and such that the specified widths are maintained throughout. Joints shall be of thickness equal to the difference between the actual and nominal dimensions of the masonry units in either height or length but in no case shall the joints be less than  $\frac{1}{4}$  inch nor more than  $\frac{1}{2}$  inch wide. Joints shall be tooled slightly concave. Tooling shall be accomplished when mortar is thumbprint hard and in a manner that will compress and seal the mortar joint and produce joints of straight and true lines free of tool marks.

### **3.10.9 Joint Reinforcement**

Unless otherwise shown, joint reinforcement shall be spaced at  $\frac{16}{16}$  inches on center vertically. Joint reinforcement shall not be placed in the same masonry course as veneer anchors unless the anchors are designed to accommodate the wire. Joint reinforcement shall be placed so that longitudinal wires are centered in the veneer wythe for solid units. Longitudinal wires shall be fully embedded in mortar for their entire length. Splices in joint reinforcement shall be lapped a minimum of  $\frac{6}{6}$  inches. Joint reinforcement must be discontinuous at all veneer joints. The minimum cover for joint reinforcement is  $\frac{5}{8}$  inches.

### **3.10.10 Veneer Joints**

[AM#1]

Brick expansion joints shall be provided at the locations shown on the drawings. Details of joints shall be as indicated on the drawings. Joints shall be clean and free of mortar and shall contain only backer rod and sealant, installed in accordance with Section 07920 JOINT SEALING. Horizontal reinforcement shall not extend through the joints. Veneer joints (expansion or control joints) shall be provided at a maximum of 20'-0" on centers in masonry.

### **3.10.11 Weep Holes**

[AM#1]

Weep holes shall be provided at all through wall flashing locations Weep holes shall be placed in head joints just above the flashing.

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Weep hole vents shall be used. Weep holes shall be kept free of mortar and other obstructions, and spaced 32" O.C.

### **3.10.12 Head Joint Vents**

Head joint vents shall be provided near the top of the veneer wythe at the same spacing as the weep holes.

### **3.10.13 Discontinuous Work**

When necessary to temporarily discontinue the work, masonry shall be stepped back for joining when work resumes. Tooothing may be used only when specifically approved. Before resuming work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned. Top of walls subjected to rain or snow shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimum of \~2 feet~\ down on each side of the wall and be held securely in place.

#### **3.10.14 Cleaning**

Mortar daubs or splashings shall be completely removed from finished exposed masonry surfaces before they harden or set up. Before completion of the work, all defects in mortar joints shall be raked out as necessary, filled with mortar, and tooled to match the adjacent existing mortar in the joints. The proposed cleaning method shall be done on the sample wall panel and the sample panel shall be examined for discoloration or stain. If the sample panel is discolored or stained, the method of cleaning shall be changed to ensure that the masonry surfaces in the structure will not be adversely affected. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Cleaning shall be accomplished with the use of stiff bristle fiber brushes, wooden paddles, wooden scrapers, or other suitable nonmetallic tools. The exposed brick surfaces shall be saturated with water and cleaned with a proprietary brick cleaning agent recommended by the clay products manufacturer. The cleaning agent shall not adversely affect the brick masonry surfaces. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Concrete masonry unit surfaces shall be dry-brushed at the end of each day's work after any required pointing has been done. Efflorescence or other stains shall be removed in conformance with the recommendations of the masonry unit manufacturer. After construction and cleaning, masonry surfaces shall be left clean, free of mortar daubs, stain, and discolorations, including scum from cleaning operations, and will have tight mortar joints throughout. Metallic tools and brushes shall not be used for cleaning.

#### **3.11 BUILDING EXPANSION JOINTS**

Expansion joints shall be located where indicated and shall be of the size and details shown.

[AM#1]

#### **3.12 MORTAR COLLECTION DEVICE**

Mortar collection devices shall be installed over all through wall flashing per written instructions.

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SECTION 07532 - ELASTOMERIC SHEET ROOFING SYSTEM (CSPE)

**PART**

**1 - GENERAL**

**1.1 REFERENCES**

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- \-ASTM D 413-\ (1982 (R 1988)) Rubber Property - Adhesion to Flexible Substrate
- \-ASTM D 751-\ (1989) Coated Fabrics
- \-ASTM D 1149-\ (1991) Rubber Deterioration - Surface Ozone Cracking in a Chamber
- \-ASTM D 1204-\ (1984) Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
- \-ASTM D 2136-\ (1984 (R 1989)) Coated Fabrics - Low-Temperature Bend Test
- \-ASTM D 2565-\ (1992) Operating Xenon Arc-Type Light Exposure Apparatus With and Without Water for Exposure of Plastics
- \-ASTM E 108-\ (1991 (Rev. A)) Fire Tests of Roof Coverings
- \-ASTM G 21-\ (1990) Determining Resistance of Synthetic Polymeric Materials to Fungi

FEDERAL STANDARDS (FED-STD)

- \-FED-STD-101-\ (Rev. C w/Change Notice 3) Packaging Materials

FACTORY MUTUAL ENGINEERING AND RESEARCH CORPORATION (FM)

\-FM A/S4470-\ (1986 (R 1988)) Class I Roof Covers

\-FM P7825-\ (1993) Approval Guide

UNDERWRITERS LABORATORIES INC.

\-UL RMSD-\ (1993) Roofing Materials and  
Systems Directory

\-UL 790-\ (1983 (R 1993)) Fire Resistance of  
Roof Covering Materials

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section \=01300=\ SUBMITTAL PROCEDURES:

\\*SD-01 Data\*\

\\*CSPE Sheet\*\; \\*FIO\*\.

\\*Adhesive\*\; \\*FIO\*\.

\\*Welding/Primer Reactivating Agent\*\; \\*FIO\*\.

\\*Lap Cleaner\*\; \\*FIO\*\.

\\*Sealant\*\; \\*FIO\*\.

\\*Flashing and Flashing Accessories\*\; \\*FIO\*\.

\\*Water Cutoff Mastic\*\; \\*FIO\*\.

\\*Fasteners and Plates\*\; \\*FIO\*\.

Furnish manufacturer's catalog data.

\\*Roof Insulation\*\; \\*FIO\*\.

Submit all manufacturer's catalog data required by Section \=07220=\ ROOF INSULATION, together with requirements of this section. Data shall include written acceptance by the roof membrane manufacturer of the insulation to be provided.

\\*SD-04 Drawings\*\

\\*CSPE Sheet\*\; \\*FIO\*\.

Submit membrane manufacturer's drawing indicating locations of perimeter half-sheets, spacing of perimeter and infield fasteners, and seaming data. The drawing shall reflect the project roof plan of each roof level and conditions indicated.

\\*SD-06 Instructions\*\

\\*CSPE Sheet\*\; \\*FIO\*\.

\\*Welding/Primer Reactivating Agent\*\; \\*FIO\*\.

\\*Lap Cleaner\*\; \\*FIO\*\.

\\*Lap Seam Sealant\*\; \\*FIO\*\.

\\*Lap Seam Solvent Welding Solution\*\; \\*FIO\*\.

\\*Flashing and Flashing Accessories\*\; \\*FIO\*\.

\\*Water Cutoff Mastic\*\; \\*FIO\*\.

\\*Fasteners and Plates\*\; \\*FIO\*\.

Include detailed application instructions and standard installation detail drawings where applicable.

\\*SD-08 Statements\*\

\\*Qualification of Applicator\*\; \\*FIO\*\.

\\*Qualification of Manufacturer\*\; \\*FIO\*\.

Certify that applicator meets requirements specified under paragraph entitled "Qualification of Applicator", and include names and locations of 5 qualified installations and the roofing system manufacturer's approval of applicator. Submit CSPE sheet manufacturer's approval of applicator in writing. Certify that the manufacturer meets the requirements specified under paragraph entitled "Qualification of Manufacturer."

\\*Materials\*\; \\*FIO\*\.

Certificate of compliance attesting that the materials meet specificatiuon requirements. The certificates shall list the components required for the specified ratings.

\\*Protection Plan\*\; \\*GA\*\.

The plan of protection shall show all areas to be protected, type of material used and a description of the method of inspection and repair of the roofing assembly.

\\*SD-14 Samples\*\

\\*Materials\*\; \\*GA\*\.

Samples of the following shall be submitted:

Membrane (CSPE)-----1.00 Ft.x 1.00Ft. section;  
GA.  
Scrim Reinforced Sheet -----1.00 Ft.x 1.00 Ft. section;  
FIO  
Adhesive-----8 ounces; FIO.  
Sealant (Lap Seam Solvent Welding)  
Solution and Lap Seam Sealant-----8 ounces per each; FIO

\\*SD-18 Records\*\

\\*Information Card\*\; \\*FIO\*\.

For each roofing installation, submit a typewritten card or photoengraved aluminum card containing the information listed on Form 1 located at the end of this section.

\\*Instructions to Government Personnel\*\; \\*FIO\*\.

Submit instructions meeting the requirements of paragraph entitled "Instructions to Government Personnel" and include copies of Material Safety Data Sheets (MSDS) for maintenance/repair materials.

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Qualification of Applicator

Roofing system applicator shall be approved by the CSPE sheet roofing system manufacturer and shall have a minimum of three years experience as an approved applicator with that manufacturer. Applicator shall have applied 5 installations

of similar size and scope as this project, within the previous 3 years.

### **1.3.2 Qualification of Manufacturer**

CSPE sheet manufacturer shall have manufactured the membrane specified herein for at least 3 years.

### **1.3.3 Fire Safety**

Complete roof covering assembly shall:

a. Have \-ASTM E 108-\ Class 1A or \-UL 790-\ Class A classification;

and

b. Be listed as Fire-Classified roof deck construction in the \-UL RMSD-\ or Class I roof deck construction in \-FM P7825-\.

UL approved components of the roof covering assembly shall bear the UL label.

### **1.3.4 Wind Uplift**

Complete roof covering assembly shall be rated Class I- 90 in accordance with \-FM P7825-\ capable of withstanding an uplift pressure of \~90 pounds per square foot~\.

### **1.3.5 Preroofing Conference**

After approval of submittals and before performing roofing and insulation work, including associated work, the Contracting Officer will hold a preroofing conference to review the following:

a. Drawings and specifications;

b. Procedure for onsite inspection and acceptance of roofing substrate and pertinent structural details relating to the roofing system;

c. Contractor's plan for coordination of work of the various trades involved in providing the roofing system and other components secured to the roofing; and

d. Safety requirements.

[AM#1]

Preroofing conference shall be attended by the Contractor and personnel directly responsible for installation of roofing and insulation, flashing and sheet metal work, mechanical and electrical work and a representative of the roofing materials manufacturer. Before beginning roofing work, confirm in writing the resolution of conflicts among those attending the preroofing conference.

**1.4 DELIVERY, STORAGE, AND HANDLING**

**1.4.1 Delivery**

Deliver materials in manufacturers' original unopened containers or wrappings with manufacturer's labels intact and legible. Roll wrappings shall be intact, without tears. Do not use rolls found with torn wrapping or which show evidence of having been opened when delivered onsite. Where materials are covered by a referenced specification number, labels shall bear the specification number, type, class, compliance with UL requirements, date of manufacture, and shelf life expiration date where applicable. Deliver materials in sufficient quantity to allow the work to proceed without interruption.

**1.4.2 Storage**

Store and protect materials from damage and weather in accordance with manufacturer's instructions, except as specified otherwise. Keep materials clean and dry. Use pallets to support and canvas tarpaulins to completely cover stored material. Do not use polyethylene sheet as a covering. Locate materials temporarily stored on the roof in approved areas. Distribute the load to stay within live load limits of the roof construction. Do not double-stack CSPE-loaded pallets. Place only those materials to be used during one day's work on the roof at one time. Remove unused materials from the roof at the end of each day's work.

**1.4.3 Handling**

When hazardous materials are involved, adhere to special precautions of the manufacturer and the applicable MSDS. Adhesives contain petroleum distillates and are extremely flammable; prevent personnel from breathing vapors, and do not use near sparks or open flame. Do not use materials

contaminated by exposure to moisture. Remove contaminated materials from the site.

### 1.5 ENVIRONMENTAL REQUIREMENTS

Do not install elastomeric sheet roofing during high winds or inclement weather, or when there is ice, frost, moisture, or visible dampness on the substrate surface. Unless recommended otherwise by the CSPE sheet manufacturer, do not install CSPE sheet when air temperature is below  $\sim 40$  degrees F or within  $\sim 5$  degrees F of the dewpoint.

### 1.6 WARRANTY

Furnish the roofing manufacturer's premium warranty for the roofing system, including insulation, flashing, and accessories. The warranty shall run directly to the Government. In no event shall the warranty period be less than 10 years from the date of the Government's acceptance of the work, notwithstanding roofing applicator's or manufacturer's unpaid invoices for installation, supplies, or service. The warranty shall state that:

a. When within the warranty period the CSPE sheet roofing system becomes nonwatertight, splits, tears, or separates at the seams because of defective materials and workmanship, the repair or replacement of defective materials and correction of defective workmanship shall be the responsibility of the CSPE sheet manufacturer;

b. When the manufacturer or the manufacturer's approved applicator fail to perform repairs within 72 hours of notification, emergency repairs performed by others will not void the warranty; and

[AM#1]

c. Damage to the CSPE roofing system caused by sustained winds having a velocity of  $\sim 90$  miles per hour or less is covered by the warranty.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 CSPE Sheet

[AM#1]

Chlorosulfonated polyethylene (CSPE)  $\sim$  \_\_\_\_\_  $\sim$   $\sim 45$ -mil  $\sim$  nominal thickness with high strength polyester scrim for

fully adhered application. Width and length of sheet shall be as recommended by the manufacturer. CSPE polymer shall represent 90 percent by weight minimum of the total polymer portion of the rubber compound.

**2.1.1.1 Scrim Reinforced Sheet**

Scrim reinforced CSPE sheet shall be high strength, minimum 10 X 10 polyester and have the following values when tested for the listed properties in accordance with the listed test methods:

<u>Method</u>	<u>Property</u>	<u>Value</u>	<u>Test</u>
D 751	\~Thickness, min., inch	.041	ASTM
D 751	Tensile Strength, min., lbf	200	ASTM
D 751	Elongation, min., percent	20	ASTM
D 751	Tear Strength, min., lbf (Tongue tear 8 inch x 8 inch sample)	75	ASTM
D 2136	Low Temperature Flexibility at -40 degrees C	Pass	ASTM
D 1204	Linear Dimension Change, max. percent (1 hour at 100 degrees C)	1.0	ASTM
D 413,	Ply Adhesion, min., lbf/in. Type A Specimen	10.0	ASTM
D 751,	Hydrostatic Resistance, min., psi Method A	200	ASTM
FED-STD-101,	Puncture Resistance, min., lbs Test Method 2031	225	

D 1149, Method B	Ozone Resistance (7 x Magnification 28 days/40 degrees C/100 pphm)	No cracks	ASTM
D 2565 BH2	Accelerated Weather Resistance, 5,000 Hours (7 x Magnification)	No checking, Type cracking or crazing	ASTM
G 21, sustained	Fungi Resistance	No 21 days growth or	ASTM

discoloration]~\

#### **2.1.2 Adhesive**

As supplied and warranted by the CSPE sheet manufacturer's printed data.

#### **2.1.3 Lap Cleaner**

As recommended by the CSPE sheet manufacturer's printed data.

#### **2.1.4 Lap Seam Solvent Welding Solution and Lap Seam Sealant**

As recommended by the CSPE sheet manufacturer's printed data.

#### **2.1.5 Water Cutoff Mastic and Sealant**

As recommended by the CSPE sheet manufacturer's printed data.

#### **2.1.6 Flashing and Flashing Accessories**

Flashing, including perimeter flashing and flashing around roof penetrations, shall be the same material as field sheet, either reinforced or nonreinforced, or as recommended by the CSPE sheet manufacturer's printed instructions. Provide nonreinforced \~55-mil~\, noncured membrane for

field-fabricated vent stack flashing, pipe flashing, and corners.

#### **2.1.7 Welding/Primer Reactivating Agent**

As recommended by the CSPE sheet manufacturer's printed data.

#### **2.1.8 Fasteners and Plates**

[AM#1]

Non-corrosive, as supplied and warranted by the CSPE sheet manufacturer's printed data, and conforming to requirements of \-FM A/S4470-\ . Plates shall not be made of plastic. CSPE to be fully adhered application and by installing fasteners and plates.

#### **2.1.9 Rubber Walkboards**

Provide the following:

##### **2.1.9.1 Rubber Walkboards**

\~3/4 inch~\ minimum thickness, weighing not less than \~1 1/2 pound per square foot~\.

#### **2.1.10 Roof Insulation Below CSPE Sheet**

Insulation shall be compatible with membrane as recommended in membrane manufacturer's printed instructions and as specified in Section \=07220=\ ROOF INSULATION. Facers of the insulation shall be a type permitting both fully adhered and mechanically fastened methods of membrane attachment.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

Coordinate work with that of other trades to ensure that components which are to be incorporated into the roofing system are available to prevent delays or interruptions as work progresses. Examine substrate to which roofing material is to be applied to ensure that its condition is satisfactory for roofing application. Do not permit voids greater than \~1/8 inch~\ wide in the substrate. Concrete substrates shall be cured and free of laitance and curing compounds. Install wood blocking at perimeters, curbs, and penetrations for use in mechanically attaching the membrane, unless recommended otherwise by the CSPE sheet manufacturer's

printed instructions. Substrates for roofing materials shall be dry and free of oil, dirt, grease, sharp edges, and debris. Inspect substrates, and correct defects before application of CSPE sheets.

### **3.2 APPLICATION**

Apply entire CSPE sheet utilizing fully adhered application methods.

#### **3.2.1 Special Precautions**

a. Do not dilute coatings or sealants unless specifically recommended by the CSPE sheet manufacturer's printed application instructions. Do not thin liquid materials with cleaners used for cleaning CSPE sheet.

b. Keep liquids in airtight containers, and keep containers closed except when removing materials.

c. Use liquid components, including adhesives, at least 60 days before the end of their shelf life period. Store adhesives at \~60 to 80 degrees F~\ for at least 24 hours prior to use. Avoid excessive adhesive application and adhesive spills. Follow adhesive manufacturer's printed application instructions.

d. Require workmen and others who walk on the membrane to wear clean, soft-soled shoes to avoid damage to roofing materials.

e. Do not use equipment with sharp edges which could puncture the CSPE sheet.

f. Install sheet material the same day the CSPE sheet roll is removed from its protective wrapping. Protect unused portions of CSPE sheet from direct exposure to sunlight until installed.

g. Protection of finished roofing assembly shall be provided. Contractor shall protect the membrane from possible damage that may result from the work of other trades. After completion of all work by other trades on roof related areas, Contractor shall remove the roof protection and inspect the roof. Any and all damaged roof assembly areas shall be repaired at this time in accordance with recommendations of the roofing manufacturer.

### **3.2.2 Work Sequence**

Arrange work to prevent use of newly constructed roofing for storage, walking surface, or equipment movement. Where access is necessary, provide temporary walkways, platforms, or runways to protect new roofing surfaces and flashings from mechanical damage.

### **3.2.3 CSPE Sheet Roofing**

Sheet shall be watertight and visually free of pinholes, particles of foreign matter, undispersed raw material, or other manufacturing defects that might affect serviceability. Edges of sheet shall be straight and flat so that sheets may be seamed to each other without fishmouthing. Clean surfaces to be seamed of cured (activated) CSPE material prior to hot air seaming. Every seam made each day shall be 100 percent probed by the end of that day's work. Permanently mark and promptly repair each defect in accordance with manufacturer's repair recommendations.

#### **3.2.3.1 Fully Adhered CSPE Sheets**

Turn back unrolled sheet one-half its width and apply the contact adhesive to substrate and underside of sheet by method and at rates recommended by CSPE sheet manufacturer's printed instructions. Do not apply adhesive to the area. Position CSPE sheet so that selvage overlaps previous sheet at least  $\sim 50$  mm  $\sim 2$  inches  $\sim$ , or as required by CSPE sheet manufacturer's printed instructions. Allow contact adhesive to dry as recommended by CSPE sheet manufacturer's printed instructions. Roll each sheet into "dried" adhesive carefully so as to avoid wrinkles, air pockets, and fishmouths, and press sheet solidly into adhesive coated substrate. Repeat this procedure on other half of sheet. Solvent wipe laps and heat- or solvent-weld or adhesively seam laps in accordance with CSPE sheet manufacturer's printed instructions. Check seams to ensure continuous seal before proceeding with further work.

#### **3.2.3.2 Perimeter Fastening**

Mechanically secure CSPE sheet to nailers at roof perimeter and penetrations with specified fasteners, or as recommended by CSPE sheet manufacturer's printed instructions. Space fasteners a maximum of  $\sim 8$  inches  $\sim$  o.c., except as recommended otherwise by CSPE sheet manufacturer's printed

data. Strip flash over fasteners with a fully adhered layer of flashing material. Type of flashing materials and procedures for strip flashing shall be as recommended in CSPE sheet manufacturer's printed instructions.

#### **3.2.3.3 Temporary Work**

Install temporary cutoffs around incomplete edges of roofing assembly at the end of each day's work and when work must be postponed due to inclement weather. Straighten insulation line using pieces of insulation loosely laid, and seal CSPE sheet membrane to deck. Seal metal deck ribs as part of cutoff. Remove temporary seals completely when work resumes. Provide temporary ballast on roofing as necessary to prevent wind damage to CSPE sheet.

#### **3.2.4 Flashing**

Install flashing as roofing sheets are installed in accordance with printed instructions of CSPE sheet manufacturer. Extend base flashing not less than ~8 inches~\ above roofing surface. Completely adhere flashing sheets in place. Provide prefabricated pipe seals at pipe penetrations where possible, otherwise field-fabricate pipe seals as specified in paragraph entitled "Flashing and Flashing Accessories".

#### **3.2.5 Insulation**

Insulation or protection board must be approved by CSPE sheet manufacturer for use in fully adhered applications. Provide insulation manufacturer's approved fasteners and plates. Leave no voids between adjacent boards of insulation.

#### **3.2.6 Roof Walkways**

Install rubber walkways, where indicated, for traffic areas and for access to mechanical equipment, in accordance with CSPE sheet manufacturer's printed instructions.

### **3.3 FIELD QUALITY CONTROL**

#### **3.3.1 Roof Drain Test**

After completing roofing, but prior to Government acceptance, perform the following test for watertightness. Plug roof drains and fill with water to edge of drain sump for 24

hours. Do not plug secondary overflow drains. To ensure some drainage from roof, do not test all drains at same time. Measure water levels at beginning and end of the 24-hour period. When precipitation occurs during test period, repeat test. When water level falls, remove water, thoroughly dry, and inspect installation; repair or replace roofing at drain. Repeat test until there is no water leakage.

### 3.3.2 Instructions to Government Personnel

[AM#6]

Furnish written and verbal instructions to designated Government personnel. Instructions shall be given by a competent representative of the CSPE sheet manufacturer and shall include a minimum of 4 hours on maintenance and emergency repair of membrane. Include demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and repair operations. Fourteen (14) calendar day notice shall be given to the Contracting Officer prior to the day instructions are to be given. The entire Instruction Session shall be video tape in VHF format, labeled and submitted to the Contracting officer.

### 3.4 INFORMATION CARD

For each roof, provide a typewritten card, laminated in plastic for interior display, or a photoengraved 1/8-inch-thick aluminum card for exterior display. Card shall be 8 1/2 by 11 inches minimum and contain the information listed on Form 1 located at end of this section. Install card near point of access to roof or where indicated. Send a photostatic paper copy to the Contracting Officer.

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INSTRUCTIONS FOR FORM 1 (Do Not Post)

1. Location: Name of activity as shown on contract.
2. Bldg. Name: As shown on contract or as provided by Contracting Officer.
3. Bldg. Number: As provided by Contracting Officer.
4. Roof Area: Area in square feet of roof for which deck insulation, membrane, etc. are the same. A separate form is required if any part of roof system is different over other areas of the roof.
5. Contract Number: As shown on the contract.
7. Show deck slope in  $\text{mm per meter}$   $\text{inches per foot}$ .
8. Deck: Check appropriate block.
9. Type of Insulation Board: Check appropriate block.
11. Show minimum thickness of installed insulation.
12. Vapor Treatment: Check appropriate blocks.
13. Show vapor treatment system manufacturer's name.
14. Roofing Type: Check appropriate block.
15. Show roofing manufacturer's name.
16. Roofing Installer's or Contractor's name.
17. Roofing Application Method: Check appropriate block.
18. Warranty Period: Insert start and end dates.
20. Show date roofing was accepted by the Contracting Officer. Warranty period begins on this date.
21. Show Government Inspector's name.

ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-98-B-0040

22. Prime Contractor Name/Address/Signature: Must be signed  
and dated by  
[QC Manager] [an official of Contracting firm].

FORM 1, ROOFING SYSTEM DESCRIPTION

1. Location \_\_\_\_\_
2. Bldg. Name \_\_\_\_\_
3. Bldg. No. \_\_\_\_\_ 4. Roof Area (\^SQ. METERS^\ \~SF~\)
5. Contract No. \_\_\_\_\_
6. New Construction: [ ] Yes [ ] No
7. Deck Slope: \_\_\_\_\_
8. Type of Deck:
- |   |  |
|---|--|
| <input type="checkbox"/> Metal                        | <input type="checkbox"/> Wood Plank or |
| <input type="checkbox"/> Plywood                      |  |
| <input type="checkbox"/> Cast-In-Place Concrete       | <input type="checkbox"/> Other         |
| _____   |  |
| <input type="checkbox"/> Precast/Prestressed Concrete |  |
9. Type of Insulation Board:
- |   |   |
|---|---|
| <input type="checkbox"/> Polyisocyanurate/Composite | <input type="checkbox"/> Polyisocyanurate |
| <input type="checkbox"/> Foam                       |   |
| <input type="checkbox"/> Polystyrene/Composite      | <input type="checkbox"/> Polystyrene      |
| <input type="checkbox"/> Perlite                    | <input type="checkbox"/> Mineral Fiber    |
| <input type="checkbox"/> Other _____                |   |
10. Insulation Manufacturer:
- \_\_\_\_\_
11. Insulation Thickness: \_\_\_\_\_
12. Vapor Treatment: Total coverage [ ] Yes [ ] No
- |   |   |
|---|---|
| <input type="checkbox"/> No Vapor Retarder  | <input type="checkbox"/> Bituminous Vapor |
| <input type="checkbox"/> Retarder           |   |
| <input type="checkbox"/> One Way Roof Vents | <input type="checkbox"/> Laminated Kraft  |
| <input type="checkbox"/> Paper              |   |
| <input type="checkbox"/> Other _____        |   |
13. Vapor Treatment Manufacturer(s):
- \_\_\_\_\_

14. Roofing Type:

- |  |   |                               |
|--|---|-------------------------------|
| <input type="checkbox"/> Built-Up (Asphalt)  | <input type="checkbox"/> PIB              | <input type="checkbox"/> TPA  |
| <input type="checkbox"/> Built-Up (Coal-Tar) | <input type="checkbox"/> Modified Bitumen | <input type="checkbox"/> EPDM |
| <input type="checkbox"/> Metal               | <input type="checkbox"/> CSPE             | <input type="checkbox"/> PVC  |
| <input type="checkbox"/> Shingles            | <input type="checkbox"/> Other _____      |                               |

15. Roofing Manufacturer:

\_\_\_\_\_

16. Roofing Installer/Warrantor:

\_\_\_\_\_

17. Roofing Application Method:

- Bitumen             Fully Adhered             Loose-Laid  
Ballasted  
 Mechanically    Torched                             Other
- \_\_\_\_\_
- Fastened  
 Mechanically Fastened/Fully Adhered

18. Warranty Period: From \_\_\_\_\_ To \_\_\_\_\_

19. Warranty Serial Number: \_\_\_\_\_

20. Date Roofing Completed: \_\_\_\_\_ 21. Inspector:

\_\_\_\_\_

22. Prime Contractor Name/Address:

\_\_\_\_\_

Signature: \_\_\_\_\_

\_\_\_\_\_

Date:

SECTION 08110

STEEL DOORS AND FRAMES

02/95

**PART**

**1 GENERAL**

**1.1 REFERENCES**

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 236-\ (1989; R 1993) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box

\-ASTM C 976-\ (1990) Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box

\-ASTM D 2863-\ (1991) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

\-ASTM E 90-\ (1990) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

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

DOOR AND HARDWARE INSTITUTE (DHI)

\-DHI A115.1G-\ (1994) Installation Guide for Doors and Hardware

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

\-NAAMM HMMA 862-\ (1987) Hollow Metal Manual; Section:  
Guide Specifications for Commercial  
Security Hollow Metal Doors and  
Frames

\-NAAMM HMMA 865-\ (1995) Hollow Metal Manual; Section:  
Guide Specifications for Swinging  
Sound Control Hollow Metal Doors and  
Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 80-\ (1995) Fire Doors and Windows

\-NFPA 80A-\ (1993) Protection of Buildings from  
Exterior Fire Exposures

\-NFPA 101-\ (1997) Safety to Life from Fire in  
Buildings and Structures

\-NFPA 252-\ (1995) Fire Tests of Door Assemblies

STEEL DOOR INSTITUTE (SDOI)

\-SDOI SDI-100-\ (1991) Standard Steel Doors and  
Frames

\-SDOI SDI-106-\ (1996) Standard Door Type  
Nomenclature

\-SDOI SDI-107-\ (1984) Hardware on Steel Doors  
(Reinforcement - Application)

**1.2 SUBMITTALS**

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section \=01300=\ SUBMITTAL PROCEDURES:

\\*SD-04 Drawings\*\

\\*Steel Doors and Frames\*\; \\*FIO\*\.

Drawings using standard door type nomenclature in accordance with \-SDOI SDI-106-\ indicating the location of each door and frame, elevation of each model of door and frame, details of

construction, method of assembling sections, location and extent of hardware reinforcement, hardware locations, type and location of anchors for frames, and thicknesses of metal. Drawings shall include catalog cuts or descriptive data for the doors, frames, and weatherstripping including air infiltration data and manufacturers printed instructions.

\\*SD-09 Reports\*\

\\*Fire Rated Doors\*\; \\*FIO\*\.

A letter by a nationally recognized testing laboratory which identifies the product manufacturer, type, and model; certifying that the laboratory has tested a sample assembly in accordance with \-NFPA 252-\ and issued a current listing for same.

\\*SD-13 Certificates\*\

[AM#1]

\\*Fire Rated Doors\*\; \\*FIO\*\.  
\\*Thermal Insulated Doors\*\; \\*FIO\*\.

a. Certification of Oversized Fire Doors: Certificates of compliance in accordance with the requirements of \-NFPA 252-\ for fire doors exceeding the sizes for which label service is available.

[AM#1]

b. Certification of Thermal Insulating Rating: Certification or test report for \_\_\_\_\_ thermal insulated doors shall show compliance with the specified requirements. The certification, or test report, shall list the parameters and the type of hardware and perimeter seals used to achieve the rating.

\\*SD-14 Samples\*\

\\*Steel Doors and Frames\*\; \\*FIO\*\.

Manufacturer's standard color samples of factory applied finishes.

### 1.3 DELIVERY AND STORAGE

During shipment, welded unit type frames shall be strapped together in pairs with heads at opposite ends or shall be

provided with temporary steel spreaders at the bottom of each frame; and knockdown type frames shall be securely strapped in bundles. Materials shall be delivered to the site in undamaged condition, and stored out of contact with the ground and under a weathertight covering permitting air circulation. Doors and assembled frames shall be stored in an upright position in accordance with \-DHI A115.1G-\. Abraded, scarred, or rusty areas shall be cleaned and touched up with matching finishes.

#### 1.4 WARRANTY

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

### PART 2 PRODUCTS

#### 2.1 DOORS AND FRAMES

[AM#1]

Doors and frames shall be factory fabricated in accordance with \-SDOI SDI-100-\ and the additional requirements specified herein. Door grade [AM#6] and frames shall be heavy duty (Grade II) unless otherwise indicated on the door and door frame schedules. Exterior doors, \_\_\_\_\_ and frames shall be designation A40 galvanized. Doors and frames shall be prepared to receive hardware conforming to the templates and information provided under Section \=08700=\ BUILDERS' HARDWARE. Doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts as required. Doors and frames shall be reinforced for surface applied hardware. Frames shall be welded type as shown. Door frames shall be furnished with a minimum of three jamb anchors and one floor anchor per jamb. Anchors shall be not less than 18 gauge steel or 7 gauge diameter wire. For wall conditions that do not allow the use of a floor anchor, an additional jamb anchor shall be provided. Rubber silencers shall be furnished for installation into factory predrilled holes in door frames; adhesively applied silencers are not acceptable. Where frames are installed in plaster or masonry walls, plaster guards shall be provided on door frames at hinges and strikes. Full glass doors shall conform to \-SDOI SDI-100-\, Model 3, and shall include provisions for glazing. Reinforcing of door assemblies for closers and other required hardware shall be in accordance with \-SDOI SDI-100-\ and the conditions of the fire door assembly listing when applicable. Exterior doors shall have top edges closed flush and sealed against water penetration.

#### 2.2 \\*THERMAL INSULATED DOORS\*\

[AM#6]

The interior of thermal insulated doors shall be completely filled with rigid plastic foam permanently bonded to each face panel. The thermal conductance (U-value) through the door shall not exceed 0.41 btu/hr times sq f times f~\ when tested as an operational assembly in accordance with \-ASTM C 236-\ or \-ASTM C 976-\ . Doors with cellular plastic cores shall have a minimum oxygen index rating of 22 percent when tested in accordance with \-ASTM D 2863-\ . All exterior doors shall be thermal insulated doors.

### 2.3 WEATHERSTRIPPING

[AM#1]

Unless otherwise specified in Section \=08700=\ BUILDERS' HARDWARE, weatherstripping shall be as follows: Weatherstripping for head and jamb shall be manufacturer's standard elastomeric type of synthetic rubber, vinyl, or neoprene and shall be installed at the factory or on the jobsite in accordance with the door frame manufacturer's recommendations. Weatherstripping for bottom of doors shall be as shown. Air leakage rate of weatherstripping shall not exceed \_\_\_\_\_ \~0.20 cfm per linear foot~\ of crack when tested in accordance with \-ASTM E 283-\ at standard test conditions. [AM#6] All exterior doors shall be weatherstripped.

[AM#1] \_\_\_\_\_

### 2.4 FACTORY FINISH

[AM#1]

Doors and frames \_\_\_\_\_ shall be phosphatized and primed with standard factory primer system. Color shall be in accordance with Section 09000 BUILDING COLOR AND FINISH SCHEDULE.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Installation shall conform to \-DHI-02-  
,\,[AM#6] \_\_\_\_\_ the interior of all fully grouted frames shall be given a bituminous coating. Preparation for surface applied hardware shall be in accordance with \-SDOI SDI-107-\ . Rubber silencers shall be installed in door frames after finish painting has been completed; adhesively applied

silencers are not acceptable. Weatherstripping shall be installed at exterior door openings to provide a weathertight installation. Installation and operational characteristics of fire doors shall be in accordance with \-NFPA 80-\, \-NFPA 80A-\ and \-NFPA 101-\. Hollow metal door frames shall be solid grouted in masonry walls.

### **3.1.1 Thermal Insulated Doors**

Hardware and perimeter seals shall be adjusted for proper operation. Doors shall be sealed weathertight after installation of hardware and shall be in accordance with Section \=07920=\ JOINT SEALING.

### **3.2 FIELD PAINTED FINISH**

Steel doors, frames and louvers shall be field painted in accordance with Section \=09900=\ PAINTING, GENERAL. Weatherstrips shall be protected from paint. Finish shall be free of scratches or other blemishes. Color shall be in accordance with Section 09000 BUILDING COLOR AND FINISH SCHEDULE.

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SECTION 08330

OVERHEAD ROLLING DOORS

06/97

**PART**

**1 GENERAL**

**1.1 REFERENCES**

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 653-\ (1996) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process

\-ASTM E 84-\ (1996a) Surface Burning Characteristics of Building Materials

\-ASTM E 330-\ (1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS (ASHRAE)

\-ASHRAE-03-\ (1993) Handbook, Fundamentals I-P Edition

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

\-NEMA ICS 2-\ (1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC

\-NEMA ICS 6-\ (1993) Industrial Control and Systems Enclosures

\-NEMA MG 1-\ (1993; Rev 1, Rev 2, Rev 3) Motors  
and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 70-\ (1996) National Electrical Code

\-NFPA 80-\ (1995) Fire Doors and Windows

## **1.2 DESCRIPTION**

Overhead rolling doors shall be spring counterbalanced, rolling type, with interlocking slats, complete with guides, fastenings, hood, brackets, and operating mechanisms, and shall be designed for use on openings as indicated. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model/serial number of the door. Doors in excess of the labelled size shall be deemed oversize and shall be provided with a listing agency oversize label, or a listing agency oversize certificate, or a certificate signed by an official of the manufacturing company certifying that the door and operator have been designed to meet the specified requirements.

### **1.2.1 Wind Load Requirements**

Doors and components shall be designed to withstand the minimum design wind load of 25 psf. Doors shall be constructed to sustain a superimposed load, both inward and outward, equal to 1-1/2 times the minimum design wind load. The door shall support the superimposed loads for a minimum period of 10 seconds without evidence of serious damage and shall be operable after conclusion of the tests. Test data showing compliance with design windload requirements for the specific door design tested in accordance with the uniform static air pressure difference test procedures of \-ASTM E 330-\ shall be provided.

### **1.2.2 Counter Balance Springs**

The counter balance spring shall be designed to operate through a minimum number of 10 cycles per day. One complete cycle of door operation is defined as when the door is in the closed position, moves to the full open position, and returns to the closed position.

## **1.3 SUBMITTALS**

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

\\*SD-01 Data\

\\*Overhead Rolling Door Unit\; \\*FIO\.

Manufacturer's catalog data, test data, and summary of forces and loads on the walls/jambs.

\\*SD-04 Drawings\

\\*Overhead Rolling Door Unit\; \\*FIO\.

Drawings showing the location of each door including schedules. Drawings shall include elevations of each door type, details and method of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, details of joints and connections, and details of guides, power operators, controls, and other fittings.

\\*SD-06 Instructions\

\\*Overhead Rolling Door Unit\; \\*FIO\.

Manufacturer's preprinted installation instructions.

\\*SD-09 Reports\

\\*Tests\; \\*FIO\.

Written record of fire door drop test.

\\*SD-13 Certificates\

\\*Fire Doors\; \\*FIO\.

Oversize labels or certificates stating that the overhead rolling doors conform to requirements of this section. Certificates for oversize fire doors stating that the doors and hardware are manufactured in compliance with the requirements for doors of this type and class and have been tested and meet the requirements for the class indicated. Certificate is not required when fire door has a listing agency label or oversize label on the door bottom bar.

\\*SD-14 Samples\*\

\\*Overhead Rolling Door Unit\*\; \\*FIO\*\.

Manufacturer's standard color samples of factory applied finishes.

\\*SD-19 Operation and Maintenance Manuals\*\

\\*Operation Manual\*\; \\*FIO\*\.

\\*Maintenance and Repair Manual\*\; \\*FIO\*\.

Six copies of the system operation manual and system maintenance and repair manual for each type of door and control system.

#### **1.4 DELIVERY AND STORAGE**

Doors shall be delivered to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Doors shall be stored in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

#### **1.5 WARRANTY**

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

#### **1.6 OPERATION AND MAINTENANCE MANUALS**

Operating instructions outlining the step-by-step procedures required for motorized door and shutter operation for the overhead rolling door unit shall be provided. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed shall be provided. A complete list of parts and supplies, source of supply, and a list of the high mortality maintenance parts shall be provided.

## **PART 2 PRODUCTS**

### **2.1 OVERHEAD ROLLING DOORS**

Doors shall be surface-mounted type with guides at jambs set back a sufficient distance to clear the opening. Exterior doors shall be mounted on interior side of walls.

#### **2.1.1 Curtains**

The curtains shall roll up on a barrel supported at the head of opening on brackets, and shall be balanced by helical torsion springs. Steel slats for doors less than 15 feet wide shall be minimum bare metal thickness of 0.0269 inches. Slats shall be of the minimum bare metal decimal thickness required for the width indicated and the wind pressure specified above.

[AM#6]

##### **2.1.1.1 \_\_\_\_\_ Insulated Curtains**

The slat system shall supply a minimum R value of 4 when calculated in accordance with \-ASHRAE-03-\. Slats shall be of the flat type as standard with the manufacturer. Slats shall consist of a urethane core not less than 11/16 inch thick, completely enclosed within metal facings. Exterior face of slats shall be gauge as specified for curtains. Interior face shall be not lighter than 0.0209 inches. The insulated slat assembly shall have a flame spread rating of not more than 25 and a smoke development factor of not more than 50 when tested in accordance with -ASTM E 84-.

#### **2.1.2 Endlocks and Windlocks**

The ends of each alternate slat shall have steel endlocks of manufacturer's stock design. In addition to endlocks, non-rated exterior doors shall have the manufacturer's standard windlocks as required to withstand the wind load. Windlocks shall prevent the curtain from leaving guides because of deflection from specified wind pressure.

#### **2.1.3 Bottom Bar**

[AM#1]

The curtain shall have a off-set bottom bar consisting of two hot-dip galvanized steel angles for steel doors. \_\_\_\_\_

#### **2.1.4 Guides**

Guides shall be steel structural shapes or formed steel shapes, of a size and depth to provide proper clearance for operation and resistance under the design windload. Guides shall be attached to adjoining construction with fasteners recommended by the manufacturer. Spacing of fasteners shall be as required to meet the minimum design windload. Doors and guides in hazardous areas shall have static grounding.

#### **2.1.5 Barrel**

The barrel shall be steel pipe or commercial welded steel tubing of proper diameter for the size of curtain. Deflection shall not exceed 0.03 inch per foot of span. Ends of the barrel shall be closed with metal plugs, machined to fit the pipe. Aluminum plugs are acceptable on non-fire door barrels.

#### **2.1.6 Springs**

Oil tempered helical steel counter-balance torsion springs shall be installed within the barrel and shall be capable of producing sufficient torque to assure easy operation of the door curtain. Access shall be provided for spring tension adjustment from outside of the bracket without removing the hood.

#### **2.1.7 Brackets**

Brackets shall be of steel plates to close the ends of the roller-shaft housing, and to provide mounting surfaces for the hood. An operation bracket hub and shaft plugs shall have sealed prelubricated ball bearings.

#### **2.1.8 Hoods**

[AM#6]

Hoods shall be steel with minimum bare metal thickness of 0.0209 inches formed to fit contour of the end brackets, and shall be reinforced with steel rods, rolled beads, or flanges at top and bottom edges. Multiple segment and single piece hoods shall be provided with support brackets of the manufacturer's standard design as required for adequate support. Support brackets shall be spaced at 24-inches on center. The joint of the hood and the structure shall be sealed with sealant as recommended by door manufacturer.

#### **2.1.9 Weatherstripping**

Exterior doors shall be fully weatherstripped. A compressible and replaceable weather seal shall be attached to the bottom bar. Weather seal at door guides shall be continuous vinyl or neoprene, bulb or leaf type, A weather baffle shall be provided at the lintel or inside the hood. Weatherstripping shall be easily replaced without special tools.

#### **2.1.10 Operation**

Doors shall be operated by means of hand-chain Equipment shall be designed and manufactured for usage in non-hazardous areas.

##### **2.1.10.1 Manual Hand-Chain Operation**

Operation shall be by means of a galvanized endless chain extending to within 3 feet of floor. Reduction shall be provided by use of roller chain and sprocket drive or suitable gearing, to reduce the pull required on hand chain to not over 35 pounds. Gears shall be high grade gray cast iron.

##### **2.1.11 Locking**

Locking shall consist of chain lock keeper, suitable for padlock by others, for chain operated doors.

##### **2.1.12 Finish**

[AM#6]

Steel slats and hoods shall be hot-dip galvanized G60 in accordance with \-ASTM A 653-\, and shall be treated for paint adhesion and shall receive a factory baked-on prime coat for field finishing. The paint system shall withstand a minimum of 1500 hours without blistering, bubbling, or rust. Surfaces other than slats, hood, and faying surfaces shall be cleaned and treated to assure maximum paint adherence and shall be given a factory dip or spray coat of rust inhibitive metallic oxide or synthetic resin primer. The factory prime finish is to match the specified for the finish color. Color shall be in accordance with Section \=09000=\ BUILDING COLOR AND FINISH SCHEDULE.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

Doors shall be installed in accordance with approved detail drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, hardware, and other accessories shall be accurately located. Upon completion, doors shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

**3.2 FIELD PAINTED FINISH**

[AM#1]

Steel doors and frames shall be field painted in accordance with Section \=09000=\ BUILDING COLOR AND FINISH SCHEDULE. Weatherstrips shall be protected from paint. Finish shall be free of scratches or other blemishes. Color shall be in accordance with Section \=09915=\ BUILDING COLOR AND FINISH SCHEDULE.

**3.3 \+TESTS+\**

The fire doors shall be drop tested in accordance with \-NFPA 80-\ to show proper operation and full automatic closure and shall be reset in accordance with the manufacturer's instructions. A written record of initial test shall be provided to the Contracting Officer.

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SECTION 08353

OPERABLE PARTITIONS

05/95

**PART**

**1 GENERAL**

**1.1 REFERENCES**

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM E 84-\ (1995a) Surface Burning  
Characteristics of Building Materials

\-ASTM E 90-\ (1990) Laboratory Measurement of  
Airborne Sound Transmission Loss of  
Building Partitions

\-ASTM E 413-\ (1987; R 1994) Rating Sound  
Insulation

\-ASTM F 793-\ (1993) Standard Classification of  
Wallcovering by Durability  
Characteristics

CODE OF FEDERAL REGULATIONS (CFR)

\-28 CFR 36-\ Nondiscrimination on the Basis of  
Disability by Public Accommodations  
and in Commercial Facilities

FEDERAL STANDARDS (FED-STD)

\-FED-STD 795-\ (Basic) Uniform Federal Accessibility  
Standards

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

\-NEMA LD 3-\ (1991) High-Pressure Decorative  
Laminates

UNDERWRITERS LABORATORIES (UL)

\-UL 10B-\ (1993) Fire Tests of Door Assemblies

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section \=01330=\ SUBMITTAL PROCEDURES:

\\*SD-01 Data\*\

\\*Operable Partitions\*\; \\*FIO\*\.

Manufacturer's descriptive data, performance charts, catalog cuts, and installation instructions.

\\*SD-04 Drawings\*\

\\*Operable Partitions\*\; \\*FIO\*\.

Drawings containing complete schematic diagrams and details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

\\*SD-13 Certificates\*\

\\*Materials\*\; \\*FIO\*\.

\\*Operable Partitions\*\; \\*FIO\*\.

Certificate attesting that the materials meet the requirements specified and that partitions have specified acoustical and flame retardant properties, as determined by test.

\\*SD-14 Samples\*\

\\*Operable Partitions\*\; \\*GA\*\.

Manufacturer's standard color samples of specified surfaces and finishes.

\\*SD-19 Operation and Maintenance Manuals\*\

\\*Operable Partitions\*\; \\*FIO\*\.

Six complete copies of operating instructions outlining the procedures required for partitions. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and operating features. Data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 year and 3 years of service.

Six complete copies of maintenance instructions explaining routine maintenance procedures including inspection, adjustments, lubrication, and cleaning. The instructions shall list possible breakdown, methods of repair, and a troubleshooting guide. The instructions shall include equipment layout and simplified wiring and control diagrams of the system as installed.

### **1.3 DELIVERY AND STORAGE**

Materials shall be delivered to the jobsite in the manufacturer's original, unopened packages and shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

### **1.4 WARRANTY**

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

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Partition finishes shall have a Class A rating when tested in accordance with \-ASTM E 84-\.

**2.1.1 Wall Covering**

The wall covering shall conform to Partition manufacturers standard as indicated in Section 09000 - BUILDING COLOR AND FINISH SCHEDULE.

**2.1.2 Hardware**

[AM#1]

Operable partitions shall have manufacturers standard hardware. Hardware shall be bronze finish aluminum.

**2.1.3 Sweep Strips**

Sweep strips shall be vinyl or other material which will not crack or craze with severe usage. Sweep strip shall control STC to the specified rating.

**2.1.4 Track**

Track shall be recessed and shall be of extruded aluminum. Track shall be manufacturer's standard product designed for the weight of door. Track sections shall be provided in the maximum lengths practicable, not less than ~6 feet~ long except for narrow doors and at ends of runs where short length is required. Suitable joint devices such as interlocking keys shall be provided at each joint to provide permanent alignment of track.

**2.1.5 Metal Soffit**

[AM#1]

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**2.2 \\*OPERABLE PARTITIONS\*\**

[AM#1]

Operable partitions shall consist of top hung ball bearing carriers which support single modular panels. Panels shall be not more than ~4 feet~ wide, except for end closure panels, and shall be full height to track. Panels shall have surface material which wraps around the vertical panel edges with vertical trim of bronze finished aluminum. Panels shall be constructed of kil-dried clear factory grade wood members with wood corner gussets and cross bracing and rigid structural panels on both sides of wood frame. [AM#6] Panel frames may be

constructed of aluminum or steel if the incorporate the same gusset, cross bracing and rigidstructural panels as specified above. Panel thickness and composition shall be designed to provide an STC rating **[AM#6]**

46-49 in accordance with \-ASTM E 90-\ and \-ASTM E 413-\ . Doors shall have vinyl sweep top seals which compress against the bottom of the top track. Bottom seals shall be a vinyl sweep mechanical seal which will expand in place or panels which will be lowered by self-contained operating device. Panels shall lock in place to form a stable, rigid partition. Panels shall be surfaced with wall covering . Partition finish shall have a flame spread rating of not more than 25 in accordance with \-ASTM E 84-\ . Doors shall be non fire rated manually operated.

### **2.3 COLOR**

Color shall be in accordance with Section \= 09000=\ BUILDING COLOR AND FINISH SCHEDULE.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

Installation shall be in accordance with the manufacturer's approved installation instructions.

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SECTION 08700

BUILDERS' HARDWARE

03/96

**PART**

**1 GENERAL**

**1.1 REFERENCES**

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

\-BHMA-01-\ (Effective thru Jun 1995) Directory of Certified Locks & Latches

\-BHMA-02-\ (Effective thru Jul 1995) Directory of Certified Door Closers

\-BHMA-03-\ (Effective thru Jul 1996) Directory of Certified Exit Devices

\-BHMA A156.1-\ (1988) Butts and Hinges

\-BHMA A156.3-\ (1994) Exit Devices

\-BHMA A156.4-\ (1992) Door Controls - Closers

\-BHMA A156.5-\ (1992) Auxiliary Locks & Associated Products

\-BHMA A156.6-\ (1994) Architectural Door Trim

\-BHMA A156.7-\ (1988) Template Hinge Dimensions

\-BHMA A156.8-\ (1994) Door Controls - Overhead Holders

\-BHMA A156.13-\ (1994) Mortise Locks & Latches

\-BHMA A156.16-\ (1989) Auxiliary Hardware

\-BHMA A156.18-\ (1993) Materials and Finishes

\-BHMA A156.20-\ (1989) Strap and Tee Hinges and Hasps

\-BHMA A156.21-\ (1989) Thresholds

DOOR AND HARDWARE INSTITUTE (DHI)

\-DHI-03-\ (1989) Keying Systems and Nomenclature  
\-DHI-04-\ (1976) Recommended Locations for Builders'  
Hardware for Custom Steel Doors and Frames  
\-DHI-05-\ (1990) Recommended Locations for  
Architectural Hardware for Standard Steel  
Doors and Frames  
\-DHI-A115.IG-\ (1994) Installation Guide for Doors and  
Hardware  
\-DHI A115-W-\ (Varies) Wood Door Hardware Standards (Incl  
A115-W1 thru A115-W9)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 80-\ (1995) Fire Doors and Windows  
\-NFPA 101-\ (1994) Safety to Life from Fire in Buildings  
and Structures

**1.2 SUBMITTALS**

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section \=01330=\ SUBMITTAL PROCEDURES:

\\*SD-01 Data\*\

\\*Hardware and Accessories\*\; \\*FIO\*\.

Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions. Spare parts data for locksets, exit devices, closers, electric locks, electric strikes, electro-magnetic closer holder release devices, and electric exit devices, after approval of the detail drawings, and not later than 3 month(s) prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

\\*SD-04 Drawings\*\

\\*Hardware Devices\*\; \\*GA\*\.

Detail drawings for hardware devices for computerized keying systems, magnetic cards, keyless push button access control systems, and other electrical hardware devices showing complete wiring and schematic diagrams and other details required to demonstrate proper function of units.

\\*SD-07 Schedules\*\

\\*Hardware Schedule\*\; \\*FIO\*\.

Hardware schedule listing all items to be furnished. The schedule shall include for each item: the quantities; manufacturer's name and catalog numbers; the ANSI number specified, sizes; detail information or catalog cuts; finishes; door and frame size and materials; location and hardware set identification cross-references to drawings; lock trim material thicknesses; lock trim material evaluation test results; corresponding reference standard type number or function number from manufacturer's catalog if not covered by ANSI or BHMA; and list of abbreviations and template numbers.

\\*Keying Schedule\*\; \\*GA\*\.

Keying schedule developed in accordance with \-DHI-03-\, after the keying meeting with the user.

\\*SD-13 Certificates\*\

\\*Hardware and Accessories\*\; \\*FIO\*\.

The hardware manufacturer's certificates of compliance stating that the supplied material or hardware item meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of the product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply. A statement that the proposed hardware items appear in \-BHMA-01-\, \-BHMA-02-\ and \-BHMA-03-\ directories of certified products may be submitted in lieu of certificates. Furnish a separate certificate of compliance attesting that hardware items conform to the section 00700 Contract clauses pertaining to the "Buy American Act".

\\*SD-14 Samples\*\

\\*Locksets\*\; \\*GA\*\.

Furnish a sample of the locksets to be furnished this project. Notify the Contracting Officer and base personnel for a meeting demonstrating that the locksets to be furnished are fully compatible with the existing keying system. An existing base core, cylinder, and key will be fitted to the sample lockset. The core and cylinder shall fit the lockset without the use of adapters and without play. The key shall easily lock and unlock the lockset without binding or other difficulties. Control key shall easily remove and install cores.

### **1.3 PREDELIVERY CONFERENCE**

Upon approval of the Hardware Schedule, the construction Contractor shall arrange a conference with the hardware supplier, Contracting Officer and the using agency to determine keying system requirements. Location of the key control storage system, set-up and key identification labeling will also be determined.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

Hardware shall be delivered to the project site in the manufacturer's original packages. Each article of hardware shall be individually packaged in the manufacturer's standard commercial carton or container, and shall be

properly marked or labeled to be readily identifiable with the approved hardware schedule. Each change key shall be tagged or otherwise identified with the door for which its cylinder is intended. Where double cylinder functions are used or where it is not obvious which is the key side of a door, appropriate instructions shall be included with the lock and on the hardware schedule. Manufacturer's printed installation instructions, fasteners, and special tools shall be included in each package.

**1.5 SPECIAL TOOLS**

Special tools, such as those supplied by the manufacturer, unique wrenches, and dogging keys, shall be provided as required to adjust hardware items.

**1.6 WARRANTY**

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

**1.7 OPERATION AND MAINTENANCE MANUALS**

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides shall be provided. The instructions for electric locks, electric strikes, electro-magnetic closer holder release devices, and electric exit devices shall include simplified diagrams as installed.

**PART 2 PRODUCTS**

**2.1 GENERAL HARDWARE REQUIREMENTS**

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Hardware set numbers correspond to the set numbers shown on the drawings.

**2.2 TEMPLATES**

Requirements for hardware to be mounted on metal doors or metal frames shall be coordinated between hardware manufacturer and door or frame manufacturer by use of templates and other information to establish location, reinforcement required, size of holes, and similar details. Templates of hinges shall conform to \-BHMA A156.7-\.

**2.3 HINGES**

Hinges shall conform to \-BHMA A156.1-\ . Hinges used on metal doors and frames shall also conform to \-BHMA A156.7-\ . Except as otherwise specified, hinge sizes shall conform to the hinge manufacturer's printed recommendations.

**2.4 LOCKS AND LATCHES**

To the maximum extent possible, locksets, latchsets and deadlocks shall be the products of a single manufacturer. Lock fronts for double-acting doors shall be rounded. Strikes for wood frames and pairs of wood doors shall be furnished with wrought boxes.

#### **2.4.1 Mortise Lock and Latchsets**

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform to \-BHMA A156.13-\, operational Grade 1. Strikes for security doors shall be rectangular without curved lip. Mortise type locks and latches for doors \~1-3/4 inches~\ thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts.

#### **2.4.2 Auxiliary Locks and Associated Products**

Bored and mortise dead bolts shall conform to \-BHMA A156.5-\. Bolt and latch retraction shall be dead bolt style. Strike boxes shall be furnished with dead bolt.

#### **2.4.3 Lock Cylinders (Mortise, Rim and Bored)**

Lock cylinders shall comply with \-BHMA A156.5-\. Lock cylinder shall have not less than seven pins. Cylinders shall have key removable type cores. master keying system shall be provided. Construction interchangeable cores shall be provided. Disassembly of knob or lockset shall not be required to remove core from lockset. All locksets, exit devices, and padlocks shall accept same interchangeable cores.

#### **2.4.4 Lock Trim**

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of \-BHMA A156.2-\ or \-BHMA A156.13-\, knobs, lever handles, escutcheons shall be \^1.27 mm^\ \~0.050 inch~\ thick, if unreinforced. If reinforced, the outer shell shall be \^0.89 mm^\ \~0.035 inch~\ thick and the combined thickness shall be \^1.78 mm^\ \~0.070 inch~\. Lever handles shall be of plain design with ends returned to no more than \^10 mm^\ \~1/2 inch~\ from the door face. Lever handle shall be of solid construction.

### **2.5 EXIT DEVICES AND EXIT DEVICE ACCESSORIES**

Exit devices and exit device accessories shall conform to \-BHMA A156.3-\, Grade 1.

#### **2.5.1 Exit Devices and Auxiliary Items**

Trim shall be of wrought construction and commercial plain design with straight, beveled, or smoothly rounded sides, corners, and edges. Adjustable strikes shall be provided for rim type and vertical rod devices. Open back strikes shall be provided for pairs of doors with mortise and vertical rod devices; except open back strikes shall be used on labeled doors only where specifically provided for in the published listings. Touch bars shall be provided in lieu of conventional crossbars and arms. Escutcheons shall be provided not less than \~7 by 2-1/4 inches~\ Escutcheons shall be cut to suit cylinders and operating trim.

#### **2.5.2 Electric Exit Devices**

Electric exit devices shall conform to \-BHMA A156.3-\ with factory installed electric lock modification having the capability to lock or unlock

from remote location by means of push button . Exit devices shall comply with life safety requirements of \-NFPA 101-\. In hazardous locations, products shall use safe power supplies or be pneumatic.

## 2.6 KEYING

Locks shall be keyed in sets or subsets as scheduled. Locks shall be furnished with the manufacturer's standard construction key system. Change keys for locks shall be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." Keys shall be supplied as follows:

Locks:	3 change keys each lock.
Master keyed sets:	4 keys each set.
Construction keys:	6 total.
Blank keys:	<u>200</u> total. AM #6

The keys shall be furnished to the Contracting Officer arranged in a container for key control system storage] in sets or subsets as scheduled.

## 2.7 DOOR CLOSING DEVICES

Door closing devices shall conform to \-BHMA A156.4-\, Grade 1. Closing devices shall be products of one manufacturer for each type specified. The opening resistance of closing devices shall not exceed \~15 lbf~\ applied at the latch stile or exceed \~5 lbf~\ where low opening resistance is scheduled.

## 2.8 DOOR CONTROLS - OVERHEAD HOLDERS

Door controls - overhead holders shall conform to \-BHMA A156.8-\.

## 2.9 ARCHITECTURAL DOOR TRIM

Architectural door trim shall conform to \-BHMA A156.6-\.

### 2.9.1 Door Protection Plates

#### 2.9.1.1 Kick Plates

Kick plates shall be Type J102 stainless steel. Width of plates shall be  $\wedge 50 \text{ mm}^{\wedge}$  \~2 inches~\ less than door width for single doors and  $\wedge 25 \text{ mm}^{\wedge}$  \~1 inch~\ less for pairs of doors. Height shall be  $\wedge, \wedge$  \~10 inches,~\ except where the bottom rail is less than  $\wedge \wedge$  \~10 inches~\ the plate shall extend to within  $\wedge 13 \text{ mm}^{\wedge}$  \~1/2 inch~\ of the panel mold or glass bead. Edges of metal plates shall be beveled.

#### 2.9.1.2 Mop Plates

Mop plates shall be Type J103 stainless steel. Width of plates shall be \~2 inches~\ less than door width for single doors and  $\wedge$  \~1 inch~\ less for pairs of doors. The height shall be \~4 inches.~\ Edges of metal plates shall be beveled.

### 2.9.2 Push Plates

#### 2.9.2.1 Combination Push-Pull Plates

Combination push-pull plates shall be Type J303,  $\sim 0.050$  inch thick minimum stainless steel beveled four edges.

#### **2.9.2.2 Flat Plates**

Flat plates shall be Type J301  $\sim 0.50$  inch thick stainless steel. Edges of metal plates shall be beveled.

#### **2.9.3 Door Pulls and Push/Pull Units**

##### **2.9.3.1 Door Pulls**

Door pulls shall be Category J400 stainless steel of plain modern design. Pulls for hollow metal, mineral core wood or kalamein doors shall be Type J405 thru-bolted to Type J301 flat push plates.

#### **2.10 AUXILIARY HARDWARE**

Auxiliary hardware, consisting of shall conform to  $\sim$  BHMA A156.16. Lever extension flush bolts shall be Type L14081. Dust-proof strikes shall be Type L04011 for doors that are not fire rated. Dust-proof strikes shall be Type L04021 for fire rated doors. Other auxiliary hardware of the types listed below, shall conform to  $\sim$  BHMA A156.16.

#### **2.11 MISCELLANEOUS**

##### **2.11.1 Metal Thresholds**

Thresholds shall conform to  $\sim$  BHMA A156.21. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping. Thresholds for use with floor closers shall conform to  $\sim$  BHMA A156.4. Where required, thresholds shall be modified to receive projecting bolts of flush bolt exit devices. Thresholds for doors accessible to the handicapped shall be beveled with slopes not exceeding 1:2 and with heights not exceeding  $\sim 1/2$  inch. Air leakage rate of weatherstripping shall not exceed  $\sim 0.5$  cubic feet per minute per lineal foot of crack when tested in accordance with  $\sim$  ASTM E 283 at standard test conditions.

##### **2.11.2 Rain Drips**

Extruded aluminum, not less than  $\sim 0.07$  inch thick, bronze anodized. Door sill rain drips shall be  $\sim 1-1/2$  inches to  $1-3/4$  inches high by  $\sim 5/8$  inch projection. Overhead rain drips shall be approximately  $\sim 1-1/2$  inches high by  $\sim 2-1/2$  inches projection and shall extend  $\sim 2$  inches on either side of the door opening width.

##### **2.11.3 Key Control Storage System**

Key control storage system shall conform to  $\sim$  BHMA A156.5, Type E8351, capacity as required, be properly labeled for key identification. Set up, identification labeling and location of the key control storage shall be as directed at the Predelivery Conference.

#### **2.12 FASTENINGS**

Fastenings of proper type, size, quantity, and finish shall be supplied with each article of hardware. Machine screws and expansion shields shall be used for attaching hardware to concrete or masonry. Fastenings exposed to the weather in the finished work shall be of brass, bronze, or stainless steel. Sex bolts, through bolts, or machine screws and grommet nuts, where used on reverse-bevel exterior doors equipped with half-surface or full-surface hinges, shall employ one-way screws or other approved tamperproof screws. Screws for the jamb leaf of half-mortise and full-surface hinges attached to structural steel frames shall be one-way or other approved tamperproof type.

### **2.13 FINISHES**

Unless otherwise specified, finishes shall conform to those identified in \-BHMA A156.18-\. Where painting of primed surfaces is required, painting is specified in Section \=09900=\ PAINTING, GENERAL.

### **2.14 HARDWARE FOR FIRE DOORS**

Hardware for fire doors shall conform to the requirements of \-NFPA 80-\ and \-NFPA 101-\.

## **PART 3 EXECUTION**

### **3.1 APPLICATION**

Hardware shall be located in accordance with \-DHI-04-\ and \-DHI-05-\. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with \-DHI-A115.IG-\ or \-DHI A115-W-\. Door control devices for exterior doors such as closers and holders, shall be attached to doors with thru bolts and nuts or sex bolts. Alternate fastening methods may be approved by the Contracting Officer when manufacturers' documentation is submitted to verify that the fastening devices and door reinforcements are adequate to resist wind induced stresses. Electric hardware items and access control devices shall be installed in accordance with manufacturer's printed installation procedures.

#### **3.1.1 Hardware for Fire Doors and Smoke-Control Door Assemblies**

Hardware for fire doors shall be installed in accordance with the requirements of \-NFPA 80-\. Exit devices installed on fire doors shall have a visible label bearing the marking "Fire Exit Hardware". Other hardware installed on fire doors, such as locksets, closers, and hinges shall have a visible label or stamp indicating that the hardware items have been approved by an approved testing agency for installation on fire-rated doors. Hardware for smoke-control door assemblies shall be installed in accordance with \-NFPA 105-\.

#### **3.1.2 Door-Closing Devices**

Door-closing devices shall be installed and adjusted in accordance with the templates and printed instructions supplied by the manufacturer of the devices. Insofar as practicable, doors opening to or from halls and corridors shall have the closer mounted on the room side of the door.

**3.1.3 Key Control Storage Systems**

Key control storage system shall be installed where directed.

**3.1.4 Kick Plates and Mop Plates**

Kick plates shall be installed on the push side of single-acting doors and on both sides of double-acting doors. Mop plates shall be installed on the pull side of the single acting doors.

**3.1.5 Auxiliary Hardware**

Lever extension flush bolts shall be installed at the top and bottom of the inactive leaf of pairs of doors. The bottom bolt shall operate into a dust-proof floor strike or threshold.

**3.1.6 Thresholds**

Thresholds shall be secured with a minimum of three fasteners per single door width and six fasteners per double door width with a maximum spacing of \~12 inches.\~\ Exterior thresholds shall be installed in a bed of sealant with expansion anchors and stainless steel screws, except that bronze or anodized bronze thresholds shall be installed with expansion anchors with brass screws. Minimum screw size shall be No. 10 length, dependent on job conditions, with a minimum of \~3/4 inch~\ thread engagement into the floor or anchoring device used. Thresholds shall have ends scribed neatly to jambs.

**3.1.7 Rain Drips**

Door sill rain drips shall align with the bottom edge of the door. Overhead rain drips shall align with bottom edge of door frame rabbet. Drips shall be set in sealant and fastened with stainless steel screws.

**3.1.8 Weatherseals**

Weatherseals shall be located as indicated, snug to door face and fastened in place with color matched metal screws after door and frames have been finish painted. Screw spacing shall be as recommended by manufacturer.

**3.2 \+OPERATIONAL TESTS+\**

Prior to acceptance of any electrical hardware system, an operational test shall be performed to determine if devices are operating as intended by the specifications. Wiring shall be tested for correct voltage, current carrying capacity, and proper grounding. Stray voltages in lock wiring shall be eliminated to prevent locking devices from releasing in critical situations.

**3.3 HARDWARE SETS**

HW-1 (Door no. 1) \_\_\_\_\_ AM #6

- 3 pr. Hinges, A2111 x 626
- 1 ea. Lockset, F07 x 626
- 2 ea. Flush bolt, L14081 x 626
- 1 ea. Dust proof strike, L04021
- 1 set Weatherstripping @ head, jambs, and sill x 628
- 1 ea. Stop, L21371 x 626

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1 ea. Rain drip cap, Pemco 346B  
1 ea. Rain Sweep, Pemco 345B  
1 ea. Threshold, J32180

HW-2 (Door no. 1A)\_\_\_\_\_AM #6

1 ½ pr. Hinges, A2111 x 626  
1 ea. Lockset, F07 x 626  
1 set Weatherstripping @ head, jambs, and sill X 628  
1 ea. Threshold, J32180  
1 ea. Stop, L21371 x 626

HW-3 (Door no. 2)\_\_\_\_\_AM #6

3 pr. Hinges, A2111 x 626  
1 ea. Lockset, F07 x 626  
1 set Flush bolt, L04081 x 626  
1 ea. Dust proof strike, L04021 x 626  
1 ea. Stop, L22141 x 626

HW-4 (Door no. 3)\_\_\_\_\_AM #6

3 pr. Hinges, A2111 x 626  
1 ea. Lockset, F07 x 626  
1 set Flush bolts L04081 x 626  
1 ea. Dust proof strike, L04021 x 626  
1 ea. Rain drip cap, Pemco 346B  
1 ea. Rain sweep, Pemco 345B  
1 set Weatherstripping @ head, jambs, and sill  
2 ea. Stops, L21371 x 626  
1 ea. Threshold, J3218

HW-5 (Door no. 5)\_\_\_\_\_AM #6

1 ½ pr. Hinges, A2111 x 626  
1 ea. Lockset, F07 x 626  
1 set Weatherstripping @ head, jambs, and sill X 628  
1 ea. Stop, L22011 x 626  
1 ea. Threshold, J32180

HW-6 (Door no.6)\_\_\_\_\_AM #6

3 pr. Hinges, A2111 x 626  
1 ea. Lockset, F07 x 626  
1 set Flush bolts, L04081 x 626  
1 ea. Dust proof strike, L04021 x 626  
2 ea. Stop, L22141 x 626  
1 set Weatherstripping @ head, jambs, and sill X 628  
1 ea. Rain drip cap, Pemco 346B  
1 ea. Rain sweep, Pemco 345B  
1 ea. Threshold, J32180

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HW-7 (Door no. 7)\_\_\_\_\_AM #6

2 sets Pivots, C07131 x Finish to match door  
 2 ea. Exit device, type 6, function 02 x electric latch retraction  
 2 ea. Power transfers, equal to Von Duprin EPT10  
 2 ea. Monitor strike, equal to Von Duprin 4690-1-T2  
 1 ea. Power supply, equal to Von Duprin PS872 x 600  
 1 ea. Lockset, F08 x 630  
 1 ea. Dead bolt, E8211 x 626  
 2 ea. Stop, L22161 x 626  
 1 set Weatherstripping head, jambs, and sill X 628  
 1 ea. Rain drip cap, Pemco 346B  
 1 ea. Rain sweep, Pemco 345B  
 AM#1 2 ea. Closer, C05021 w/PT-4D, PT-4G, PT-4H  
 (Size 1 or 2 thru 6)  
 AM#1 2 ea. Overhead stop, C011541, Finish to match door  
 1 ea. Threshold, J12180  
 2 ea. Dust proof strikes, L04021 x 626  
 AM #6 1 ea. Kickplate, J102 x 626

HW-8 (Door no. 8)\_\_\_\_\_AM #6

2 sets Pivots, C07131 x finish to match door  
 1 ea. Exit device, type 6, function 02 x electric latch retraction  
 x request to exit switch x finish to match door  
 1 ea. Exit device, type 6, function 08 x electric latch retraction  
 x request to exit switch x finish to match door.  
 AM#1 2 ea. Power tranfers, equal to Von Duprin EPT-10  
 1 ea. Monitor strike, equal to Von Duprin 4690-1-T2  
 1 ea. Power supply, equal to Von Duprin PS872 x 600  
 1 ea. Keypad accedss control, equal to Von Duprin 7321  
 1 ea. Dead bolt, E8211 x 626  
 2 ea. Stops, L22141 x 626  
 1 set Weatherstripping @ head, jambs, and sill X 628  
 1 ea. Rain drip cap, Pemco 346B  
 1 ea. Rain sweep, Pemco 345B  
 AM#1 2 ea. Closer, C05021 w/PT-4D, PT-4G, PT-4H  
 (Size 1 or 2 thru 6)  
 AM#1 2 ea. Overhead stop, C11541, Finish to match door  
 1 ea. Threshold, J12180  
 2 ea. Dust proof strikes, L04021 x 626  
 AM #6 1 ea. Kickplate, J102 x 626

HW-9 (Door no. 9)\_\_\_\_\_AM #6

2 sets Pivot, C07131 x finish to match door  
 2 ea. Exit devilce, type 6, function 04 x finish to match door  
 1 ea. Lockset, F04 x 626  
 2 ea. Stops, F22141 x 626  
 1 ea. Threshold, J12180

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HW-10 (Door no. 10)\_\_\_\_\_AM #6

2 sets Pivot, C07131 x finish to match door  
 2 ea. Exit device, type 6, function 02 x electric latch retraction x finish to match door  
 AM#1 2 ea. Power transfers, equal to Von Duprin EPT10  
 1 ea. Monitor strike, equal to Von Duprin 4690-1-T2  
 1 ea. Power supply, equal to Von Duprin PS872 x 600  
 1 ea. Dead bolt, E8211 x finish to match door  
 AM#1 2 ea. Closer, C05021 x 689, PT-4D, PT-4G, PT-4H (Size 1 or 2 thru 6)  
 AM#1 2 ea. Overhead stop, C11541, Finish to match door  
 1 set Weatherstripping @ head, jambs, and sill X 628  
 2 ea. Stops, L22161 x 828  
 2 ea. Dust proof strikes, L04021 x 626  
 1 ea. Threshold, J12180  
 2 ea. Dust proof strikes, L04021 x 630  
 AM #6 1 ea. Kickplate, J102 x 626

HW-11 (Door no. 11)\_\_\_\_\_Am #6

2 sets Pivot, C07131 x finish to match door  
 2 ea. Exit devices type 6 function 02 x electric latch retraction x finish to match door  
 1 ea. Dead bolt, E8211 x finish to match door  
 AM#1 2 ea. Closer, C05021, x 689, PT-4D, PT-4G, PT-4H (Size 1 or 2 thru 6)  
 AM#1 2 ea. Overhead stop, C11541, Finish to match door  
 1 set Weatherstripping head, jambs, and sill X 628  
 2 ea. Stops, L2011 x 626  
 2 ea. Dust proof strikes, L04021 x 630  
 AM#1 2 ea. Power transfers equal to Von Duprin  
 1 ea. Monitor strike, eaual to Von Duprin  
 1 ea. Power supply, equal to Von Duprin  
 1 ea. Threshold, J12180  
 AM #6 1 ea. Kickplate, J102 x 626

HW-12 (Door no. 12)\_\_\_\_\_AM #6

2 sets Pivot, C07131 x finish to match door  
 AM #6 2 ea. Exit devices, type 6, function 08 x finish to match door  
 1 ea. Dead bolt, E8211 x finish to match door  
 2 ea. Closers, C05051 x 689, PT-4D, PT-4G, PT-4H (Size 1 or 2 thru 6)  
 1 set Weatherstripping head, jambs, and sill X 628  
 2 ea. Stops, L22161 x 626  
 1 ea. Dust proof strike, L04021 x 626  
 1 ea. Threshold, J12180  
 AM #6 1 ea. Kickplate, J102 x 626

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HW-13 (Door no. 15)\_\_\_\_\_AM #6

1 1/2pr. Hinges, A2111 x 626  
1 ea. Pull w/plate, J407 x 626  
1 ea. Push plate, J304 X 630  
1 ea. Closer, C02021 x 689,PT-4D, PT-4G, PT-4H  
(Size 1 or 2 thru 6)  
1 ea. Kickplate, J102 x 626  
1 ea. Mop plate, J103 x 626  
1 ea. Stop, L22101

HW-14 (Door no. 16)\_\_\_\_\_AM #6

1 1/2pr. Hinges, A2111 x 626  
1 ea. Pull w/plate, J407 x 626  
1 ea. Push plate, J304 x 626  
1 ea. Closer, C22021, x 689,PT-4D, PT-4G, PT-4H  
(Size 1 or 2 thru 6)  
1 ea. Kickplate, J102 x 626  
1 ea. Mop plate, J103 x 626  
1 ea. Stop, L22101 x 626

HW-15 (Door no. 17)\_\_\_\_\_AM #6

1 1/2pr. Hinges,A2111 x 626  
1 ea. Lockset, F07 x 626  
1 ea. Stop, L02011 x 626  
1 ea. Overhead holder, C23611 x 626

HW-16 (Fire rated - 20 min.)(Door no. 18)\_\_\_\_\_AM #6

1 1/2pr. Hinges, A2111 x 626  
1 ea. Lockset, F07 x 626  
1 ea. Closer, C22021 x 689, PT-4D,PT-4G, PT-4H  
(Size 1 or 2 thru 6)  
1 ea. Stop, L22101 x 626  
1 ea. Kickplate x 626

AM #6

HW-17 (Fire rated - 20 min.)(Door 19)\_\_\_\_\_AM #6

1 1/2pr. Hinges, A2111 x 626  
1 ea. Lockset, F04 x 626  
1 ea. Closer, C22021 x 689, PT-4D, PT-4G, PT-4H  
(Size 1 or 2 thru 6)  
1 ea. Stop, L02011 x 626  
1 ea. Kickplate, J102 x 626

HW-18 (Fire rated - 20 min.)(Door no. 21 and no. 24)\_\_\_\_\_AM #6

1 1/2pr. Hinges, A2111 x 626  
1 ea. Lockset, F07 x 626  
1 ea. Stop, C22021 x PT-4D, PT-4G, PT-4H

HW-19 (Fire rated - 20 min.)(Door 22)\_\_\_\_\_AM #6

1 1/2pr. Hinges, A2111 x 626  
1 ea. Lockset, F07 x 626  
1 ea. Stop, L02011 sx 626

HW-20 (Fire rated - 20 min.)(Door no. 23)\_\_\_\_\_AM #6

1 1/2pr. Hinges, A2111 x 626  
1 ea. Lockset, F06 x 626  
1 ea. Stop, L02011 x 626  
1 ea. Closer, C05051 x 689 HW-4D, PT-4G, PT-4H  
(Size 1 or 2 thru 6)  
1 ea. Kickplate, J102 x 630

AM #6 HW-21 (Fire rated - 45 min.) Door no. 26)

1 1/2pr. Hinges, A2111 x 626  
1 ea. Exit device, Type 2, function 08 x 630  
1 ea. Stop, L22141 x 626  
1 ea. Closer, C02251 x 689, PT-4D, PT-4G, PT-4H  
(Size 1 or 2 thru 6)  
1 ea. Kickplate, J102 x 630

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SECTION 09000 - BUILDING COLOR AND FINISH SCHEDULE

**PART 1 - GENERAL**

**1.1 SUMMARY**

This section covers colors, patterns, and textures of exterior and interior floor, wall, ceiling, and equipment finish materials.

**1.2 REFERENCES TO MANUFACTURERS AND PRODUCTS**

The manufacturer's names and their products referenced in this section only indicate the color, texture, and pattern required for the materials listed. The products furnished shall meet the color, texture, and pattern indicated as well as the material quality and performance specified in the applicable technical sections. The use of manufacturer's names and products do not preclude the use of other manufacturer's products of approved equal color, texture, or pattern as long as all requirements are met.

**1.3 ABBREVIATIONS: MANUFACTURERS AND MATERIALS**

<u>Abbreviation</u>	<u>Material</u>	<u>Manufacturer</u>	<u>Mfgr's No/Color</u>
AF-1	Access Flooring Laminated	InterfaceAR	Tec-Crete II Nevamar MR-6-1 Gray Matrix
AF-2	Access Flooring CPT-1 to be installed over floor panels in a parquet pattern.	InterfaceAR	Tec-Crete I
ATC-1	Acoustical Ceiling	Capaul	White, Symphony F/Overtone, Revealed Painted Edge with Foil Back, 24" X 24"
Brick	Brick	Acme Brick	Rosewood, Blend 148, Velour Modular
Brick Mortar	-	CPI	Medium Buff M515, 1 lb 8 oz/70 lbs Masonry Cement
CPT-1	Carpet to be installed in a parquet pattern (1/4 turn)	Interface	Safari, Base Style 4114, 2012 Explore, 19.69 x 19.69 Modular Tile

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Cast Stone	-	Continental Cast Stone	1104 Buff
Ceiling Fans		Hunter	Preference Model 23660 Antique Brass, Walnut/Oak Blades
CT-1	Ceramic Tile	Dal-tile	Matte Suede Gray 6540, 2" x 2"
CT-2	Ceramic Tile	Dal-tile	Gloss Ash Gray 6444, 2" x 2"
CT-3	Ceramic Tile	Dal-tile	Matte Blue Moon 6548, 2" x 2"
CT-4	Ceramic Tile	Dal-tile	Matte Spice 6536, 2" x 2"
CT-5	Ceramic Tile	Dal-tile	Unglazed Violet DK368, 2" x 2"
CT-6	Ceramic Tile	Dal-tile	Unglazed Old Rose DK308 2" x 2"
CT-7	Ceramic Tile	Dal-tile	Square Top Base, Matte Suede Gray 6540, 2" x 2" MDKB-5A
Corner Guards	-	Koroseal	K-15 Cloud
EFS	Exterior Finish System	USG	Sunlite, Sand Texture
GRT-1	Grout	Custom Build Prod.	#335 Winter Gray
P-1	Paint	Polomyx	404-BH12
P-2	Paint	Zolatone	43-24119
P-3	Paint	Sherwin Williams	Ermine SW 1023 Semi-Gloss
P-4	Paint	Sherwin Williams	Origami White 1025 Semi-Gloss
P-5	Paint	Sherwin Williams	Fencepost White 2074 Semi-Gloss

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[AM#1] P-6	<u>Paint</u>	<u>Sherwin Williams</u>	<u>Steeplegray</u> <u>2131</u> <u>Gloss</u>
PL-1	Plastic Laminate	Wilsonart	4622-60 Grey Nebula
PW-1	Partition Wall	Kwik-Wall	Maharam Tek-Wall 1000, #164 Sandrift Grey
Recessed Mat	-	C/S Group	Recessed Pedimat Carpet threads 9321 Pewter; Rail/Frame Architectural Bronze
[AM#6] Signage		System2/90	Background: Cool Grey Letters & Numbers: Black
Standing Seam Roof		MBCI	Signature-300 Colonial Red
QT-1	Quarry Tile	Dal-tile	Northwest 2000 Tacoma-NW50 Matte, 8" x 8"
QT-2	Quarry Tile	Dal-tile	Northwest 2000 Glacier-NW85 Matte, 4" x 8"
QT-3	Quarry Tile	Dal-tile	Northwest 2000 Kodiak-NW15 Matte, 4" x 8"
QT-4	Quarry Tile	Dal-tile	Northwest 2000 Kodiak-NW15 Matte, 4" x 4"
Qt-5	Quarry Tile	Dal-tile	Northwest 2000 Glacier-NW85 Matte, 4" x 4"
QT-6	Quarry Tile	Dal-tile	Northwest 2000 Cove Base Round Top, Q3685 Tacoma-NW50 Matte 5 3/4 x 7 3/4

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RB-1	Resilient Base	Johnsonite	Rubber, Straight 4" width, 1/8" thickness, 71-Storm Cloud
VWC-1	Vinyl Wall covering	Koroseal	Viewpoint Indian Pottery V221-55
Window Shades	-	Mecho Shade Systems	ThermoVeil Shadecloth Vertical Weave 1003 Grey
Wood Stain	-	Sherwin Williams	Wood Classic, Rustic Gray SW 3133-K On Red Oak Semi-Gloss

1.3.2 MANUFACTURERS TELEPHONE NUMBERS

MATERIAL	CONTACT	DESCRIPTION
Access Flooring	InterfaceAR David Grant 1-800-336-0225 Ext. 3892	TEC-CRETE I TEC-CRETE II/ Nevamar, MR-6-1 Gray Matrix
Acoustical Ceiling	Designed Performance Assc. Mark McLain 972-381-9100	CAPAUl-Symphony F/Overtone, White
Brick/Brick Mortar	Acme Brick Larry Clemons 817-390-2409	Brick-Rosewood 148, Velour Modular Mortar-Med. Buff M515, 11b 8oz/70 lbs Masonry Cement
Carpet	Interface Steve Savage 1-800-336-0225 Ext. 1506	Safari, 4114 2012 Explore Modular Tile
Cast Stone	Continental 1-800-989-7866	1104 Buff
Ceramic Tile	Dal-tile Donna Kohler 972-690-5724	6540,6444,6548 6536,DK368,DK308 MDKB-5A 2" x 2"

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Corner Guards	Kenmark Brady Brackin 214-348-8000	Koroseal K-15 Cloud
Exterior Finish System	USG 972-371-5990	Sunlite Sand Texture
Paint	Kenmark Terry Grimes 214-348-8000	Polomyx 404-BH-12 Zolatone 43-24119
	Sherwin Williams 1-800-382-6567	Ermine, 1023 Origami White 1025 Fencepost White 2074
Plastic Laminate	Wilsonart Teresa Davison 1-800-344-2339	4622-60 Grey Nebula
Partition Wall	Kwik-Wall A.J.Noecker 817-831-0337	Wood Series 1000 Fabric/Maharam 164 Sandrift Grey
Presentation Cabinet	Dreher Business Products 1-800-221-4686	Series 1500 72" x 48" DRP-CCHv72x48 Mahogany
Recessed mat	C/S Group 1-800-972-7214	Pedimat Carpet 9321 Pewter Rail/Frame Architectural Bronze
[AM#6] Signage	System 2/90 616-949-4310	Background: Cool Grey Letters & Numbers: Black
Standing Seam Roof	MBCI Charlie Joyner 972-988-3300	Signature 300 Colonial Red
[AM#6] Toilet Partitions Vanities	Santana 1-800-368-5002	Onyx 733
TV Mount	Bretford 1-800-343-1779	

Quarry Tile	Dal-tile Donna Kohler 214-690-5724	Tacoma-NW50 8x8 Glacier-NW85 4x8, 4x4 Kodiak-NW15 4x8, 4x4 Tacoma-NW50 Cove Base
Resilient Base	Johnsonite 1-800-899-8916	Rubber, 4" 1/8" Thick 71 Storm
Vinyl Wall covering	Kenmark Terry Grimes 214-348-8000	Koroseal Viewpoint, Indian Pottery V221-55
Window Shades	Designed Performance Associates Mark McLain 972-381-9100	Mecho Shades ThermoVeil Vertical Weave 1003 Grey
Wood Stain	Sherwin Williams 1-800-382-6567	Wood Classics Rustic Gray 3133K on Red Oak

**1.4 EXTERIOR COLOR/FINISH INSTRUCTIONS**

**1.4.1 Bollard Guards**

Bollard Guards shall be painted in stripes of colors \-FSN 595-\ Black, #13538 yellow.

**1.4.2 Brick**

Brick shall match Acme Brick, Rosewood, Blend 148, Velour Modular.

**1.4.3 Brick Mortar**

Brick mortar shall match CPI, Medium Buff M515, 1 lb 8 oz/70 lbs Masonry Cement.

**1.4.4 Control Joints on Brick**

Control joints on bricks shall match mortar in color; CPI, Medium Buff, M515, 1 lb 8 oz/70 lbs Masonry Cement.

**1.4.5 Doors and Frames**

Aluminum: Medium anodized bronze finish .

Galvanized Steel:

All exterior doors shall match P-5; Sherwin Williams, Fencepost White, 2074.

**1.4.6 Exterior Finish System**

Exterior Finish System shall match USG Sunlite, Sand Textured Finish.

**1.4.7 Glazing**

Glazing is specified in Section \=08810=\ GLASS AND GLAZING.

**[AM#1] 1.4.8 Handrails and Exposed Steel on Stairs**

Handrails shall be painted to match metal roofing; MBCI/Signature 300, Colonial Red.

**1.4.9 Misc. Metals**

Metal panels in screen wall shall be painted to match metal roof; MBCI, Signature 300, Colonial Red.

**1.4.10 Screen Walls/Coping**

Screen wall shall match Acme Brick, Rosewood, Blend 148. Coping shall match Continental Cast Stone 1104 Buff

**1.4.11 Sheet Metalwork**

**1.4.11.1 Coping**

Color finish to match Continental Cast Stone, 1104-Buff.

**1.4.11.2 Fascia**

Color finish to match Exterior Finish System (EFS); USG, Sunlite on Sand Texture

**1.4.11.3 Gutters and Downspouts**

Color finish to match metal roofing; MBIC, Signature 300, Colonial Red.

**1.4.11.4 Louvers**

Louvers shall be painted to match metal roofing; MBCI, Signature 300, Colonial Red.

**1.4.12 Stairs**

Exterior stair threads shall be finished exposed concrete with a broom finish.

**1.4.13 Standing Seam Metal Roofing**

Color finish of metal roofing shall match MBCI, Signature 300, Colonial Red.

**1.4.14 Windows**

Aluminum: Manufacturer's standard medium anodized bronze finish.

Steel: Painted shall match P-5, Sherwin Williams, Fencepost White, 2074

**[AM#1] 1.4.15**

**1.5 INTERIOR COLOR/FINISH INSTRUCTIONS**

**1.5.1 Access Flooring**

**1.5.1.1** Access flooring to be installed in B102/B,C,D202/B,D103,203/B,C,D115,215/C216 shall match InterfaceAR Tec-Crete II. Color of laminate shall match Nevamar MR-6-1, Gray Matrix.

**1.5.1.2** Access flooring to be in installed in all classrooms, corridors B,C,D 115,215 shall match InterfaceAR Tec-Crete I.

**1.5.2 Carpet**

Carpet shall match Interface Safari, Base Style 4114, 2012 Explore to be installed in a parquet pattern (1/4 turn).

**1.5.3 Ceiling Fans**

Ceiling fans shall match Hunter Preference. 5 Blades in Walnut/Oak and an Antique Brass.

**1.5.4 Ceramic Tile/Grout**

**1.5.4.1** The walls in the Mens toilet rooms shall be CT-2(Gloss Ash Gray 6540) with an accent band consisting of CT-3(Matte Blue Moon,6548) and CT-4(Matte Spice,6536). Walls in the Womens toilet rooms shall be CT-2(Gloss Ash Gray, 6540) with an accent band consisting of CT-5(Unglazed Violet, DK-368) and CT-6(Unglazed Old Rose, DK-308). See Arch. Drwgs. A-44 for ceramic tile pattern.

The floor finish shall be CT-1(Matte Suede Gray,6540). The grout for walls and floor shall match GRT-1, Custom Building Products #335 Winter Gray.

**1.5.5 Corner Guards**

Corner guards shall be installed as indicated on Arch. Drwgs. and shall match Koroseal K-15 Cloud.

**1.5.6 Doors and Frames**

**1.5.6.1** Steel frames shall be painted to match P-3; Sherwin Williams, Ermine SW 1023,Semi-Gloss.

**1.5.6.2** Wood Doors shall be Red Oak and stained to match Sherwin Williams Rustic Gray 3133 K,Semi-Gloss.

**1.5.7 Door Hardware**

Door hardware finish is specified in Section \=08700=\ HARDWARE; BUILDERS'.

#### **1.5.8 Elevators**

Elevators shall have finishes to match Dover Brushed Bronze.

##### **1.5.8.1 Metal Parts**

Metal parts shall match Dover Brushed Bronze.

##### **1.5.8.2 Handrails**

Handrails shall match Dover Brushed Bronze.

##### **1.5.8.3 Wall Panels**

Wall panels shall be Flat Wall and shall match Dover Brushed Bronze.

##### **1.5.8.4 Floor**

Floor shall be CPT-1; Interface, Safari, 2012 Explore Modular Tile installed in a parquet pattern.

##### **1.5.8.5 Ceiling**

Ceiling shall be suspended bronze frame, with louvers, to match Dover Brushed Bronze with Florescent Lighting.

##### **[AM#1] 1.5.8.6 Handrails-Skylight Area**

Handrails shall match Sherwin Williams, 2131, Steeplegray.

#### **1.5.9 Plastic Laminate**

Shelving in Janitors closets, E110,210 and F110,210 shall match PL-1 Wilsonart, 4622-60 Grey Nebula.

#### **1.5.10 Partition Wall**

Partition Wall Fabric in classrooms shall match Kwik-Wall, Maharam Tek-Wall 1000, #164 Sandrift Grey.

#### **1.5.11 Recessed Mat**

Recessed Mat shall match C/S Group Pedimat, Carpet color 9321 Pewter, Rail/Frame Architectural Bronze. Recessed Mats to be installed in B,C,D 114 and E100 & F100. See Arch. Drwgs. for placement.

#### **1.5.12 Stairs**

Thread finish shall match QT-1, Dal-tile Northwest 2000 Series, Tacoma-NW50. See Arch. Drags. A-44 for tile pattern.

#### **1.5.13 Quarry Tile**

Floor finish shall be Quarry Tile installed in a pattern. Tile shall match Dal-tile Northwest 2000; Matte Tacoma-NW50, Matte Glacier-NW85, Kodiak-NW15. See Arch. Drags A-44 for tile pattern.

**1.5.14 Quarry Tile Grout**

Quarry tile grout shall match Custom Building Products #335 Winter Gray.

**1.5.15 Resilient Base**

Resilient base shall be installed in all areas except areas where ceramic or quarry tile is specified. The color shall match Johnsonite 71 Storm Cloud, width 4" and thickness 1/8".

**1.5.16 Signs**

Exterior signs are specified in Section \=10430=\ EXTERIOR SIGNAGE and interior signs in Section \=10440=\ INTERIOR SIGNAGE. Background shall match System 2/90 S-CG Cool Grey. Letters and numbers shall match System 2/90 S-BK Black.

**1.5.17 Suspended Ceiling Grid**

Suspended Ceiling Grid shall match ceiling tiles in manufacturer's standard finish and shall be be a standard 15/16 inch grid to match Capaul's exposed tee system.

**1.5.18 Stairwells**

Ceilings in stairwells shall match ATC-1, Capaul Symphony F/Overtone, Revealed Painted Edge with Foil Backing 24" x 24", color white.

**1.5.19 Toilet Partitions and Vanity Units**

Toilet Partitions and Vanity Units shall match Santana finish Onyx 733.

**1.5.20 Vinyl Wall covering**

Vinyl Wall covering shall be installed on all three walls the define vending areas E106,206 and F106,206, water fountain areas E108,208 and F108,208.

**1.5.21 Walls**

All interior walls of gypsum board shall be painted as indicated in 1.6 Room/Finish schedule.

**[AM#1] 1.5.22**

**1.6 ROOM COLOR AND FINISH SCHEDULE**

Area: Mechanical Rm A101

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Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: - Conc P-3 P-3 P-3 P-3 Exposed  
 Structure

Area: Boiler Rm A102

Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: - Conc P-3 P-3 P-3 P-3 Exposed  
 Structure

Area: Commo Rm A103

Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: - Conc P-3 P-3 P-3 P-3 P-3

Area: Electrical Rm A104

Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: - Conc P-3 P-3 P-3 P-3 P-3

Area: Office B 100,200

Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 CPT-1 P-1 P-1 P-1 P-1 ATC-1

Area: Corridor B 101,201

Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 CPT-1 P-2 --- P-2 P-1,P-2 ATC-1

NOTE: Walls defining alcoves at entrances to B100,200 shall be P-1

Area: Commo B,C,D 102

Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-1 P-3 P-3 P-3 P-3 P-4

Area: Electrical B,C,D 202

Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-1 P-3 P-3 P-3 P-3 P-4

Area: Storage B,D 103,203

Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-1 P-3 P-3 P-3 P-3 P-4

Area: Computer Lab B,C,D 104,204

Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-2 P-1 P-1 P-1 P-1 ATC-1  
 CPT-1

Area: Classroom B,C,D 105,205

Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-2 P-1 P-1 PW-1 P-1 ATC-1  
 CPT-1

Area: Classroom B,C,D 106,206

Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-2 P-1 P-1 PW-1 P-1 ATC-1  
 CPT-1

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Area: Classroom B,C,D 107,207  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-2 PW-1 P-1 PW-1 P-1 ATC-1  
 CPT-1

Area: Classroom B,C,D 108,208  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-2 PW-1 P-1 PW-1 P-1 ATC-1  
 CPT-1

Area: Classroom B,C,D 109,209  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-2 PW-1 P-1 P-1 P-1 ATC-1  
 CPT-1

Area: Classroom B,C,D 110,210  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-2 PW-1 P-1 P-1 P-1 ATC-2  
 CPT-1

Area: Classroom B,C,D 111,211  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-2 P-1 P-1 PW-1 P-1 ATC-1  
 CPT-1

Area: Classroom B,D 112,212  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-2 P-1 P-1 P-1 P-1 ATC-1  
 CPT-1

Area: Office C212  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-2 P-1 P-1 P-1 P-1 ATC-1  
 CPT-1

Area: Classroom B,C,D 113,213  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 AF-W PW-1 P-1 P-1 P-1 ATC-1  
 CPT-1

Area: Vestibule B,C,D 114  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: QT-6 Conc Brick Brick ATC-1  
 W/recessed  
 mat, bordered  
 with QT-1

Note: See 1.5.11

Area: Vestibule B,C,D 214  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: - Conc Brick Brick ATC-1



NOTE: Walls defining alcoves at entrances to D100,200 shall be P-1.

Area: Elevator Equip D119  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: - Conc P-3 P-3 P-3 P-3 Exposed  
 Structure

Area: Mechanical Rm D120  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: - Conc P-3 P-3 P-3 P-3 Exposed  
 Structure

Area: Vestibule E100  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: QT-6 Conc Brick Brick ATC-1  
 W/recessed  
 mat, bordered  
 with QT-1

Note: See 1.5.11

Area: Office E200  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: RB-1 CPT-1 P-1 P-1 P-1 P-1 ATC-1

Area: Lobby E101,201  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: QT-6 QT-1 P-2 P-2 P-2 P-2 ATC-1  
 QT-2,QT-3  
 QT-4,QT-5

See 1.5.13 for quarry tile pattern.

Area: Stair E102,202  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: - QT-1 P-1 P-1 P-1 P-1 ATC-1

Area: Women E104,204  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: CT-7 CT-1 CT-2 CT-2 CT-2 CT-2 P-4  
 CT-5 CT-5 CT-5 CT-5  
 CT-6 CT-6 CT-6 CT-6

See 1.5.4.1 for ceramic tile pattern.

Area: Hall E105,205  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: QT-6 QT-1 P-2 P-2 --- P-2 ATC-1  
 QT-2,QT-3  
 QT-4,QT-5

See 1.5.13 for quarry tile pattern.

Area: Vending E106,206  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: QT-6 QT-1 VWC-1 --- VWC-1 VWC-1 ATC-1  
 QT-2,QT-3  
 QT-4,QT-5

See 1.5.13 for quarry tile pattern.  
 See 1.5.20 for vinyl wall covering placement.

Area: Break Area E107,207  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: QT-6 QT-1 P-2 P-2 --- --- ATC-1  
 QT-2,QT-3  
 QT-4,QT-5

See 1.5.13 for wall covering placement.

Area: Break Area E108,208  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: QT-6 QT-1 --- P-2 P-2 P-2,VWC-1 ATC-1  
 QT-2,QT-3,  
 QT-4,QT-5

See 1.5.13 for quarry tile pattern.  
 See 1.5.20 for vinyl wall covering placement.

Area: Mens Rm E109,209  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: CT-7 CT-1 CT-2 CT-2 CT-2 CT-2 P-4  
 CT-3 CT-3 CT-3 CT-3  
 CT-4 CT-4 CT-4 CT-4

See 1.5.4.1 ceramic tile pattern.

Area: Janitor Closet E110,210  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: CT-7 CT-1 CT-2 CT-2 CT-2 CT-2 P-4

Area: Corridor E111,211  
 Base Floor A Wall B Wall C Wall D Wall Ceiling  
 Matl.: QT-6 QT-1 P-2 --- P-2 --- ATC-1  
 QT-2,QT-3  
 QT-4,QT-5

See. 1.5.13 for quarry tile pattern.

Area: Storage E212  
 Base Floor A Wall B Wall C Wall D Wall Ceiling

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Matl.: - Conc P-3 P-3 P-3 P-3 P-4

Area: Vestibule F100

	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	QT-6	Conc, w/recessed mat, bordered w/QT-1	Brick	---	Brick	---	ATC-1

Note: See 1.5.11.

Area: Family Room F200

	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	RB-1	CPT-1	P-1	P-1	P-1	P-1	ATC-1

Area: Lobby F101,201

	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	QT-6	QT-1 QT-2,QT-3, QT-4,QT-5	P-2	P-2	P-2	---	ATC-1

See. 1.5.13 for quarry tile pattern.

Area: Stair F 102,202

	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	-	QT-1	P-1	P-1	P-1	P-1	ATC-1

Area: Womens Rm F 104,204

	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	CT-7	CT-1 CT-5 CT-6	CT-2 CT-5 CT-6	CT-2 CT-5 CT-6	CT-2 CT-5 CT-6	CT-2 CT-5 CT-6	P-4

See 1.5.4.1 for Ceramic tile pattern.

Area: Hall F 105,205

	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	QT-6	QT-1 QT-2,QT-3 QT-4,QT-5	P-2	P-2	---	P-2	ATC-1

See 1.5.13 for quarry tile pattern.

Area: Vending F 106,206

	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	QT-6	QT-1 QT-2,QT-3, QT-4,QT-5	VWC-1	VWC-1	VWC-1	---	ATC-1

See 1.5.13 for quarry tile pattern.

See 1.5.20 for vinyl wall covering placement.

Area:	Break Area F 107,207						
	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	QT-6	QT-1	P-2	---	---	P-2	ATC-1
		QT-2,QT-3,					
		QT-4,QT-5					

See 1.5.13 for quarry tile pattern.

Area:	Break Area F108,208						
	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	QT-6	QT-1	VWC-1	VWC-1	P-2,VWC-1	P-2	ATC-1
		QT-2,QT-3,					
		QT-4,QT-5					

See 1.5.13 for quarry tile pattern.  
See 1.5.20 for vinyl wall covering placement.

Area:	Mens Rm F109,209						
	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	CT-7	CT-1	CT-2	CT-2	CT-2	CT-2	P-4
			CT-3	CT-3	CT-3	CT-3	
			CT-4	CT-4	CT-4	CT-4	

See 1.5.4.1 for ceramic tile pattern.

Area:	Janitor Closet F110,210						
	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	CT-7	CT-1	CT-2	CT-2	CT-2	CT-2	P-4

Area:	Corridor F 111,211						
	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	QT-6	QT-1	P-2	---	P-2	---	ATC-1
		QT-2,QT-3,					
		QT-4,QT-5					

See 1.5.13 for quarry tile pattern.

**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION (Not Applicable)**

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SECTION 09310

CERAMIC TILE

10/94

**PART**

**1 GENERAL**

**1.1 REFERENCES**

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- \-ANSI A108.1A-\ (1992) Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar
- \-ANSI A108.1B-\ (1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
- \-ANSI A108.4-\ (1992) Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive
- \-ANSI A108.5-\ (1992) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
- \-ANSI A108.6-\ (1992) Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy
- \-ANSI A108.7-\ (1992) Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar
- \-ANSI A108.8-\ (1992) Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout
- \-ANSI A108.10-\ (1992) Installation of Grout in Tilework
- \-ANSI A108.11-\ (1992) Interior Installation of Cementitious Backup Units
- \-ANSI A118.1-\ (1992) Dry-Set Portland Cement Mortar
- \-ANSI A118.2-\ (1992) Conductive Dry-Set Portland Cement Mortar
- \-ANSI A118.3-\ (1992) Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive

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- \-ANSI A118.4-\ (1992) Latex-Portland Cement Mortar
- \-ANSI A118.5-\ (1992) Chemical Resistant Furan Mortars and Grouts for Tile
- \-ANSI A118.6-\ (1992) Ceramic Tile Grouts
- \-ANSI A136.1-\ (1992) Organic Adhesives for Installation of Ceramic Tile
- \-ANSI A137.1-\ (1988) Ceramic Tile

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- \-ASTM A 185-\ (1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
- \-ASTM C 33-\ (1993) Concrete Aggregates
- \-ASTM C 144-\ (1993) Aggregate for Masonry Mortar
- \-ASTM C 150-\ (1995) Portland Cement
- \-ASTM C 206-\ (1984; R 1992) Finishing Hydrated Lime
- \-ASTM C 207-\ (1991; R 1992) Hydrated Lime for Masonry Purposes
- \-ASTM C 241-\ (1990) Abrasion Resistance of Stone Subjected to Foot Traffic
- \-ASTM C 373-\ (1988) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
- \-ASTM C 648-\ (1984; R 1994) Breaking Strength of Ceramic Tile
- \-ASTM C 847-\ (1993) Metal Lath
- \-ASTM C 1026-\ (1987; R 1992) Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
- \-ASTM C 1027-\ (1984; R 1990) Determining Visible Abrasion Resistance of Glazed Ceramic Tile
- \-ASTM C 1028-\ (1989) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
- \-MIA-01-\ (1991) Design Manual IV Dimensional Stone

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- \-NFPA 99-\ (1993) Health Care Facilities

TILE COUNCIL OF AMERICA (TCA)

\-TCA-01-\ (1994) Handbook for Ceramic Tile Installation

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section \=01330=\ SUBMITTAL PROCEDURES:

\\*SD-01 Data\*\

\\*Tile\*\; \\*FIO\*\.

\\*Setting-Bed\*\; \\*FIO\*\.

\\*Mortar, Grout, and Adhesive\*\; \\*FIO\*\.

Manufacturer's catalog data.

\\*SD-06 Instructions\*\

\\*Tile\*\; \\*FIO\*\.

\\*Mortar and Grout\*\; \\*FIO\*\.

Manufacturers preprinted installation and cleaning instructions.

\\*SD-09 Reports\*\

\\*Testing\*\; \\*FIO\*\.

Copy of results for electrical resistance tests.

\\*SD-13 Certificates\*\

\\*Tile\*\; \\*FIO\*\.

\\*Mortar, Grout, and Adhesive\*\; \\*FIO\*\.

Certificates indicating conformance with specified requirements. A master grade certificate shall be furnished for tile.

\\*SD-14 Samples\*\

\\*Tile\*\; \\*GA\*\.

\\*Accessories\*\; \\*GA\*\.

Samples of sufficient size to show color range, pattern, type and joints.

## 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact.

Materials shall be kept dry, protected from weather, and stored under cover.

#### **1.4 ENVIRONMENTAL REQUIREMENTS**

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 50 degrees F and rising. Temperature shall be maintained above 50 degrees F while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

#### **1.5 WARRANTY**

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

### **PART 2 PRODUCTS**

#### **2.1 \\*TILE\*\**

##### **2.1.1 Mosaic Tile**

Ceramic mosaic tile and trim shall be unglazed porcelain gloss and matte with sharply formed face. Tile size shall be 2 by 2 inches. Color shall be indicated in 09000 BUILDING COLOR AND FINISH SCHEDULE.

##### **2.1.2 Quarry Tile**

Quarry tile and trim shall be unglazed with smooth surface. Tile shall be 8 by 8 by 1/2, 4 by 8 by 1/2, 4 by 4 by 1/2. Color shall be in accordance with Section 09000 BUILDING COLOR AND FINISH SCHEDULE.

#### **2.2 \\*SETTING-BED\*\**

The setting-bed shall be composed of the following:

##### **2.2.1 Aggregate for Concrete Fill**

Aggregate shall conform to \-ASTM C 33-\ . Maximum size of coarse aggregate shall not be greater than one-half the thickness of concrete fill.

##### **2.2.2 Portland Cement**

Cement shall conform to \-ASTM C 150-\ , Type I, white for wall mortar and gray for other uses.

##### **2.2.3 Sand**

Sand shall conform to \-ASTM C 144-\ .

##### **2.2.4 Hydrated Lime**

Hydrated lime shall conform to \-ASTM C 206-\ , Type S or \-ASTM C 207-\ , Type S.

**2.3 WATER**

Water shall be potable.

**2.4 \\*MORTAR, GROUT, AND ADHESIVE\*\**

Mortar, grout, and adhesive shall conform to the following:

**2.4.1 Latex-Portland Cement Mortar**

\-ANSI A118.4-\.

**2.4.2 Ceramic Tile Grout**

\-ANSI A118.6-\; latex-portland cement grout.

**2.4.3 Epoxy Resin Grout**

\-ANSI A118.3-\.

**2.4.4 Furan Resin Grout**

\-ANSI A118.5-\ and consist of an intimate mixture of furfuryl-alcohol resin with carbon filler and catalyst.

**2.4.5 Tile Backer Board**

Tile backer units shall be gypsum core with fiberglass mat surfaces (2 sides) with water and vapor retardant on face side.

**PART 3 EXECUTION**

**3.1 PREPARATORY WORK AND WORKMANSHIP**

Surface to receive tile shall be inspected and shall conform to the requirements of \-ANSI A108.1A-\ or \-ANSI A108.1B-\ for surface conditions for the type setting bed specified and for workmanship. Variations of surface to be tiled shall fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.
Organic Adhesives	1/8 inch in 8 ft.	1/16 inch in 3 ft.
Latex portland cement mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.
Epoxy	1/8 inch in 8 ft.	1/8 inch in 10 ft.

**3.2 GENERAL INSTALLATION REQUIREMENTS**

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades

shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

### 3.3 INSTALLATION OF WALL TILE

[AM#6]

Wall tile shall be installed in accordance with the \-TCA-01-\, method W244-98.

#### 3.3.1 Latex-Portland Cement Mortar

Latex-portland cement shall be used to install tile in accordance with \-ANSI A108.5-\. Latex portland cement shall be used when installing porcelain ceramic tile.

### 3.4 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with \-TCA-01-\, method F115-98 (Latex Portland Cement Installation).

#### [AM#1] 3.4.1 Latex-Portland Cement

Latex-portland cement mortar shall be used to install tile directly over properly cured, plane, clean concrete slabs in accordance with \-ANSI A108.5-\. Latex portland cement shall be used when installing mosaic tile. For Quarry tile grout release and penetrating sealer as recommended by manufacturer to be equal to or similar to Aqua Mix.

#### 3.4.2 Resinous Grout

When resinous grout is indicated, quarry tile shall be grouted with either furan or epoxy resin grout. Joints shall be raked and cleaned to the full depth of the tile and neutralized when recommended by the resin manufacturer. Epoxy resin grout shall be installed in conformance with \-ANSI A108.6-\. Furan resin grout shall be installed in accordance with manufacturer's instructions. Tile installed with furan resin shall be coated with wax by the tile manufacturer. Installation of resin grout shall be in strict accordance with manufacturer's instructions for proportioning, mixing, installing, and curing. Recommended temperature shall be maintained in the area and on the surface to be grouted. After grouting, tile shall be left free of grout stain.

#### 3.4.3 Ceramic Tile Grout

Ceramic Tile grout shall be prepared and installed in accordance with \-ANSI A108.10-\.

#### 3.4.4 Concrete Fill

Concrete fill shall be composed by volume of 1 part portland cement to 3 parts fine aggregate to 4 parts coarse aggregate, and mixed with water to as dry a consistency as practicable. The fill shall be spread, tamped, and

screeded to a true plane, and pitched to drains or leveled as shown. Concrete fill shall be thoroughly damp cured before application of setting-bed material. Concrete fill shall be reinforced with one layer of reinforcement, with the uncut edges lapped the width of one mesh and the cut ends and edges lapped not less than 2 inches. Laps shall be tied together with 18 gauge wire every 10 inches along the finished edges and every 6 inches along the cut ends and edges. The reinforcement shall be supported and secured in the centers of concrete fills. The mesh shall be continuous; except where expansion joints occur, mesh shall be cut and discontinued across such joints. Reinforced concrete fill shall be provided under the setting-bed where the distance between the under-floor surface and the finished tile floor surface is 2 inches or greater, and shall be of such thickness that the mortar setting-bed over the concrete fill shall be not less than 3/4 inch nor more than 1-1/4 inches thick at any point.

#### **3.4.5 Tile Backer Board**

Tile backer units shall be installed in accordance with Manufacturer's printed instructions.

#### **3.5 CONTROL JOINTS**

Joints shall be formed as indicated and sealed as specified in Section \=07920=\ JOINT SEALING.

##### **3.5.1 Walls**

Control joints shall be provided at control joints in backing material. Wherever backing material changes, a control joint shall be formed to separate the different materials.

##### **3.5.2 Floors**

Control joints shall be provided over construction joints, control joints, and expansion joints in concrete slabs. Control joints shall also be provided where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 24 to 36 feet each way in large interior floor areas and 12 to 16 feet each way in large exterior areas or areas exposed to direct sunlight or moisture. Expansion joints shall extend through setting-beds and fill.

#### **3.6 CLEANING AND PROTECTING**

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

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SECTION 10270

RAISED FLOOR SYSTEM

01/97

**PART**

**1 GENERAL**

**1.1 REFERENCES**

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI A208.1-\ (1993) Particleboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM E 84-\ (1995a) Surface Burning Characteristics of Building Materials

\-ASTM E 648-\ (1995a) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CEILING AND INTERIOR SYSTEMS CONTRACTORS ASSOCIATION (CISCA)

\-CISCA-01-\ (1987) Recommended Test Procedures for Access Floors

DEPARTMENT OF COMMERCE (DOC)

\-DOC PS 1-\ (1983) Construction and Industrial Plywood

FEDERAL SPECIFICATIONS (FS)

\-FS SS-T-312-\ (Rev B; Int Am 1; Notice 1) Tile, Floor: Asphalt, Rubber, Vinyl, and Vinyl Composition

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

\-ICBO-01-\ (1994) Uniform Building Code (3 Vol. set)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

\-NEMA LD 3-\ (1991) High-Pressure Decorative Laminates

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 75-\ (1995) Protection of Electronic Computer/Data Processing Equipment

\-NFPA 99-\ (1996) Health Care Facilities

UNDERWRITERS LABORATORIES (UL)

\-UL 779-\ (1995) Electrically Conductive Floorings

## 1.2 SYSTEM DESCRIPTION

Raised flooring shall be installed at the location and elevation and in the arrangement shown on the drawings. The floor system shall be of the stringerless type, complete with all supplemental items, and shall be the standard product of a manufacturer specializing in the manufacture of raised floor systems.

### 1.2.1 Floor Panels

[AM#6]

Floor panel testing shall be conducted in accordance with \-CISCA-01-\ . When tested as specified, all deflection and deformation measurements shall be made at the point of load application on the top surface of the panel. Floor panels shall be capable of supporting 1250 pounds concentrated load without deflecting more than 0.080 inch and without permanent deformation in excess of 0.010 inch in any of the specified tests. Floor panels shall be capable of supporting 250 pounds per square foot uniform live load without deflection more than 0.040 inch. Floor panels shall be capable of supporting 1000 pounds rolling load without deflecting more than 0.040 inch and without permanent deformation in excess of 0.020 inch. In accordance with \-CISCA-01-\ , the permanent deformation limit under rolling load shall be satisfied in all of the specified tests. In the specified tests, the permanent deformation shall

be measured after 10 passes with Wheel 1 and after 10,000 passes with Wheel 2.

### **1.2.2 Pedestals**

Pedestals shall be capable of supporting a  $22.24 \text{ kN}$   $\sim 5000$  pound axial load without permanent deformation.

### **1.2.3 Pedestal Adhesive**

Adhesive shall be capable of securing a pedestal in place with sufficient bonding strength to resist an overturning force of 1000 inch pounds.

### **1.2.4 Bond Strength of Factory Installed Floor Covering**

Bond strength of floor covering shall be sufficient to permit handling of the panels by use of the panel lifting device, and to withstand moving caster loads up to 1000 pounds, without separation of the covering from the panel.

## **1.3 SUBMITTALS**

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

\\*SD-01 Data\

\\*Raised Floor System\; \\*FIO\.

Manufacturer's descriptive data, catalog cuts, and installation instructions. The data shall include information about any design and production techniques, procedures and policies used to conserve energy, reduce material, improve waste management or incorporate green building/recycled products into the manufacturer of their components or products. Cleaning and maintenance instructions shall be included. Design calculations which demonstrate that the proposed floor system meets requirements for seismic loading, prepared in accordance with -ICBO-01-. Certified copies of test reports may be submitted in lieu of calculations.

\\*SD-04 Drawings\

\\*Raised Floor System\; \\*GA\.

Drawings showing layout of the work, sizes and details of components, details at floor perimeter, bracing to resist seismic or other lateral loads, typical cutout details including size and shape limitation, description of shop coating, and installation height above structural floor.

\\*SD-09 Reports\*\

\\*Tests\*\; \\*FIO\*\.

\\*Testing of Electrical Resistance\*\; \\*FIO\*\.

Certified copies of test reports from an approved testing laboratory, attesting that the proposed floor system components meet the performance requirements specified.

\\*SD-13 Certificates\*\

\\*Raised Floor System\*\; \\*FIO\*\.

Certificate of compliance attesting that the raised floor system meets specification requirements.

\\*Materials\*\; \\*GA\*\.

Certificates attesting that the materials meet the requirements specified.

\\*SD-14 Samples\*\

\\*Floor Panels\*\; \\*GA\*\.

\\*Pedestals\*\; \\*GA\*\.

One sample of each panel type and suspension system proposed for use.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

Materials shall be stored in original protective packaging in a safe, dry, and clean location and shall be handled in a manner to prevent damage. Panels shall be stored at temperatures between 40 and 90 degrees F, and between 20 percent and 70 percent humidity.

#### **1.5 EXTRA MATERIALS**

Spare floor panels, and spare complete pedestal assemblies\_\_\_\_\_ shall be furnished at the rate of one space for each 100 or fraction thereof required.

## **1.6 OPERATION AND MAINTENANCE MANUALS**

Provide maintenance instructions for proper care of the floor panel surface. When conductive flooring is specified, require submittal of maintenance instructions to identify special cleaning and maintenance requirements to maintain "conductivity" properties of the panel finish.

## **PART 2 PRODUCTS**

### **2.1 FLOOR PANELS**

#### **2.1.1 Panel Construction**

Except for edge panels, panel size shall be 24 by 24 inches. Finished panels shall be within a 0.010 inch tolerance of the nominal size, and shall be square within a tolerance of 0.015 inch measured corner-to-corner. The top surface of panels shall be flat within a 0.020 inch tolerance measured corner-to-corner. Panels shall be permanently marked to indicate load rating and model number. Each panel corner shall be drilled and counter sunk to accept a fastener for direct attachment to the pedestal. Contractor to provide in addition, 1% of the total carpeted floor panels that are installed and also 1% of floor panels with laminate finish that are installed for surplus.

##### **2.1.1.1 Concrete Panels**

Concrete panels shall be of lightweight structural concrete with either structural reinforcing or a die-formed, electro-galvanized steel bottom pan. All concrete surfaces including those resulting from field cuts shall be sealed with the manufacturer's standard sealer before covering the surfaces with other materials.

##### **2.1.2 Floor Covering**

Floor panels shall be surfaced with materials firmly bonded in place with waterproof adhesive. The electrical resistance shall remain stable over the life expectancy of the floor covering. Any antistatic agent used in the manufacturing process shall be an integral part of the material, and shall not be surface applied. Bolt heads or similar attachments shall not rise above the traffic surface.

##### **2.1.2.1 High Pressure Laminate**

High pressure laminate surfacing shall conform to \-NEMA LD 3-\, Grade HW 62.

#### **2.1.2.2 Carpet**

Carpet surfacing shall be field installed. Refer to SECTION 09680 CARPET.

#### **2.1.3 Edge Strip**

Panels shall be edged with extruded vinyl edge strips secured in place with mechanical interlock or adhesive bond, or shall be of a replaceable type. Top of strip shall be approximately 1/8 inch wide, and shall be flush with the floor surfacing.

#### **2.1.4 Accessories**

Floor panels; six hundred and four (604) floor panels shall be furnished with an opening on one edge to accommodate a raised floor box. Opening size shall be as required by the service module specified by SECTION 16415 ELECTRICAL WORK, INTERIOR. These panels will receive field installed carpet. Seventeen (17) floor panels with high pressure laminate surface will have a 12-inch by 16-inch hole-finished trim with and "L' shaped laminate trim.

#### **2.1.5 Resilient Base**

Base shall be as specified in SECTION 09650: RESILIENT FLOORING.

#### **2.1.6 Lifting Device**

Each individual room shall be provided with one floor panel lifting device standard with the floor manufacturer. A minimum of two devices shall be furnished.

### **2.2 PANEL SUPPORT SYSTEM**

#### **2.2.1 Pedestals**

[AM#1]

Pedestals shall be of steel or aluminum or a combination thereof. Ferrous materials shall have a factory-applied corrosion-resistant finish. Pedestal base plates shall provide a minimum of 16 square inches of bearing surface and shall be a minimum of 1/8 inch thick. Pedestal shafts shall be threaded to permit height adjustment within a range of approximately 2 inches, to permit overall floor adjustment within plus or minus\_\_\_\_0.10 inch of the required elevation, and to permit leveling of the finished floor surface within 0.062 inch in 10 feet in all directions. Locking devices shall be provided to

positively lock the final pedestal vertical adjustments in place. Pedestal caps shall interlock with panels to preclude tilting or rocking of the panels.

### **2.3 FASCIA**

Aluminum or steel fascia plates shall be provided at open ends of floor, at sides of ramps and steps, and elsewhere as required to enclose the free area under the raised floor. Steel plates shall have a factory applied baked enamel finish. Finish on aluminum plates shall be as standard with the floor system manufacturer. Fascia plates shall be reinforced on the back, and shall be supported using the manufacturer's standard lateral bracing at maximum 4 feet on center. Trim, angles, and fasteners shall be provided as required.

### **2.4 TESTS**

Raised flooring shall be factory tested by an independent laboratory at the same position and maximum design elevation and in the same arrangement as shown on the drawings for installation so as to duplicate service conditions as much as possible.

#### **2.4.1 Load Tests**

Floor panel, stringer, and pedestal testing shall be conducted in accordance with \-CISCA-01-\.

#### **2.4.2 Test for Bond Strength of Factory Installed Floor Covering**

The test panel shall be supported on pedestals and stringers as specified for the installed floor. The supports shall be braced as necessary to prevent sideways movement during the test. A test load of 1000 pounds shall be imposed on the test assembly through a hard plastic caster 3 inches in diameter and 1 inch wide. The caster shall be rolled completely across the center of the panel. The panel shall withstand 20 passes of the caster with no delamination or separation of the covering.

### **2.5 COLOR**

Color shall be in accordance with Section \=09000=\ BUILDING COLOR AND FINISH SCHEDULE.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

The floor system shall be installed in accordance with the manufacturer's instructions and with the approved detail drawings. Open ends of the floor, where the floor system does not abut wall or other construction, shall have positive anchorage and rigid support. Areas to receive raised flooring shall be maintained between 60 and 90 degrees F, and between 20 percent and 70 percent humidity for 24 hours prior to and during installation.

#### **3.1.1 Preparation for Installation**

The area in which the floor system is to be installed shall be cleared of all debris. Structural floor surfaces shall be thoroughly cleaned and all dust shall be removed. Floor coatings required for dust or vapor control shall be installed prior to installation of pedestals only if the pedestal adhesive will not damage the coating. If the coating and adhesive are not compatible, the coating shall be applied after the pedestals have been installed and the adhesive has cured.

#### **3.1.2 Pedestals**

Pedestals shall be accurately spaced, and shall be set plumb and in true alignment. Base plates shall be in full and firm contact with the structural floor, and shall be secured to the structural floor with adhesive.

#### **3.1.3 Auxiliary Framing**

Auxiliary framing or pedestals shall be provided around columns and other permanent construction, at sides of ramps, at open ends of the floor, and beneath panels that are substantially cut to accommodate utility systems. Special framing for additional lateral support shall be as shown on the approved detail drawings.

#### **3.1.4 Panels**

The panels shall be direct attached interlocked with supports in a manner that will preclude lateral movement. Perimeter panels, cutout panels, and panels adjoining columns, stairs, and ramps must be fastened to the supporting components to form a rigid boundary for the interior panels. Floors shall be level within 1/16 inch measured with a 10 foot straightedge in all directions. Cut edges of steel and wood-core panels shall

be painted as recommended by the panel manufacturer. Cut edges of composite panels shall be coated with a silicone rubber sealant or with an adhesive recommended by the panel manufacturer. Extruded vinyl edging shall be secured in place at all cut edges of all panel cut-outs to prevent abrasion of cables. Where the space below the floor is a plenum, cutouts for conduit and similar penetrations shall be closed using self-extinguishing sponge rubber.

### **3.1.5 Fascia Plates**

Exposed floor ends and exposed openings of ramps and stairs shall be covered with aluminum or steel closures.

### **3.1.6 Repair of Zinc Coating**

Zinc coating that has been damaged, and cut edges of zinc-coated components and accessories, shall be repaired by the application of a galvanizing repair paint. Areas to be repaired shall be thoroughly cleaned prior to application of the paint.

## **3.2 CLEANING AND PROTECTION**

### **3.2.1 Cleaning**

The space below the completed floor shall be free of all debris. Before any traffic or other work on the completed raised floor is started, the completed floor shall be cleaned in accordance with the floor covering manufacturer's instructions.

### **3.2.2 Protection**

Traffic areas of raised floor systems shall be protected with a covering of building paper, fiberboard, or other suitable material to prevent damage to the surface. Cutouts shall be covered with material of sufficient strength to support the loads to be encountered. Plywood or similar material shall be placed on the floor to serve as runways for installation of heavy equipment. Protection shall be maintained until the raised floor system is accepted.

[AM#6]

### **3.3 \_\_\_\_\_**

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[AM#6]

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SECTION 10440

INTERIOR SIGNAGE

05/95

**PART**

**1 GENERAL**

**1.1 REFERENCES**

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

ALUMINUM ASSOCIATION (AA)

- \-AA DAF-45-\ (1980) Designation System for Aluminum Finishes
- \-AA PK-1-\ (1989) Registration Record of Aluminum Association Alloy Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Castings and Ingot
- \-AA SAA-46-\ (1978) Standards for Anodized Architectural Aluminum

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

- \-AAMA 605.2-\ (1992; Addenda Jan 1995) Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- \-ANSI Z97.1-\ (1984; Rev 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- \-ASTM B 209-\ (1996) Aluminum and Aluminum-Alloy Sheet and Plate
- \-ASTM B 221-\ (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
- \-ASTM C 1036-\ (1991) Flat Glass

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- \-NFPA 70-\ (1996) National Electrical Code

**1.2 GENERAL**

Interior signage shall be of the sizes and types shown on the drawings, shall conform to the requirements specified herein, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Signs shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening. Contractor shall verify all signage information with contracting officer prior to purchase.

**1.3 SUBMITTALS**

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

\\*SD-01 Data\

\\*Interior Signage\; \\*FIO\.

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

\\*SD-04 Drawings\

\\*Interior Signage\; \\*FIO\.

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction. A schedule showing the location of each sign type shall be included.

\\*SD-14 Samples\

\\*Interior Signage\; \\*GA\.

One sample of each of the following sign types showing typical quality and workmanship. The samples may be installed in the work, provided each sample is identified and location recorded.

- a. Direction sign.
- b. Door sign.
- c. Building directory.
- d. Toilet signs
- [AM#6] e. Bulletin board.

Two samples of manufacturer's standard color chips for each material requiring color selection.

#### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area.

### PART 2 PRODUCTS

#### 2.1 COLOR, FINISH, AND CONTRAST

Color shall be in accordance with Section 09000 - BUILDING COLOR AND FINISH SCHEDULE. In buildings required to be handicapped-accessible, the characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast with their background - either light characters on a dark background or dark characters on a light background.

#### 2.2 CHARACTER PROPORTIONS AND HEIGHTS

Letters and numbers on signs in handicapped-accessible buildings, which do not designate permanent rooms or spaces, shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10. Characters and numbers on signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case letter X. Lower case characters are permitted. Suspended or projected overhead signs shall have a minimum character height of 3 inches.

#### 2.3 ALUMINUM ALLOY PRODUCTS

Aluminum extrusions shall be at least 1/8 inch thick, and aluminum plate or sheet shall be at least 0.0508 inch thick. Extrusions shall conform to \-ASTM B 221-\; plate and sheet shall conform to \-ASTM B 209-\. Where anodic coatings are specified, alloy shall conform to \-AA PK-1-\ alloy designation 514.0. Exposed anodized aluminum finishes shall be as shown and shall conform to \-AA SAA-46-\.

##### 2.3.1 Organic Coating

Organic coating shall conform to \-AAMA 605.2-\, with total dry film thickness not less than 1.2 mils.

#### 2.4 VINYL SHEETING FOR GRAPHICS

Vinyl sheeting for graphics shall be a minimum 0.003 inch film thickness. Film shall include a precoated pressure sensitive adhesive backing.

#### 2.5 ACRYLIC SHEET

Acrylic sheet for panels and components shall conform to \-ANSI Z97.1-\.

#### 2.6 PLAQUE SIGNS

Plaque signs shall be a modular type signage system. Signs shall be fabricated of Type ES. **Melamine plastic conforming to FS L-P-387, type NDP self-extinguishing or acrylic conforming to ANSI 297.1 as shown.**

### **2.6.1 Standard Modular Plaque Signs**

Plaque signs shall consist of matte finish Type ES plastic, thickness and size as shown. Corners of signs shall be squared with round corner end caps the same color as lettering.

Changeable message strip plaque signs shall consist of [polycarbonate] [cast acrylic] back laminated to matte finish laminated thermosetting Type ES plastic face with message slots, as detailed, for insertion of changeable message strips. Thickness and size of signs shall be as shown on the drawings. Individual 1/16 inch thick message strips to permit removal, change, and reinsertion shall be provided as detailed. Corners of signs shall be squared with round corner end caps the same color as lettering.

### **2.6.2 Type of Mounting For Plaque Signs**

Mounting for framed, hanging, and projecting signs shall be by holes and screws. Surface mounted signs shall be provided with 1/16 inch thick vinyl foam tape or countersunk mounting holes in plaques and mounting screws.

## **2.7 GRAPHICS**

### **2.7.1 Raised and Brailled Characters and Pictorial Symbol Signs (Pictograms)**

Letters and numbers on signs which designate permanent rooms and spaces in handicapped-accessible buildings shall be raised 1/32 inch upper case, sans serif or simple serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be at least 5/8 inch height, but no higher than 2 inches.

Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram shall be 6 inches minimum in height. Accessible facilities shall use the international symbol of accessibility.

### **2.7.2 Graphics Application**

Signage graphics shall conform to the following:

- a. Pressure sensitive precision cut vinyl letters shall be provided. Edges and corners of finished letter forms and graphics shall be true and clean.
- b. Message shall be applied to panel using the silkscreen process. Silkscreened images shall be executed with photo screens prepared from original art. No handcut screens will be accepted. Original art shall be defined as artwork that is a first generation reproduction of the specified art. Edges and corners shall be clean.
- c. Message shall be acrylic letters 1/8 inch thick and chemically welded to 0.125 inch thick acrylic backup sheet.
- d. Tactile characters and symbols shall be raised 1/32 inch minimum from the sign face. Signs shall be of one piece construction. Add-on characters are not acceptable.

### **2.7.3 Messages**

See drawings for message content, Type face Color and Type size.

### **2.8 ANCHORS AND FASTENERS**

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall have matching color and finish. Anchorage system shall be of the type recommended by the manufacturer of the indicated substrate. Where recommended by signage manufacturer, foam tape pads may be used for anchorage. Foam tape pads shall be minimum 1/16 inch thick closed cell vinyl foam with adhesive backing. Adhesive shall be transparent, long aging, high tech formulation on two sides of the vinyl foam. Adhesive surfaces shall be protected with a  $\sim 0.13 \text{ mm} \sim$   $\sim 5 \text{ mil} \sim$  green flatstock treated with silicone. Foam pads shall be sized for the signage as per signage manufacturer's recommendations.

### **2.9 FABRICATION AND MANUFACTURE**

#### **2.9.1 Workmanship**

Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

#### **2.9.2 Dissimilar Materials**

Where dissimilar metals are in contact, the surfaces will be protected to prevent galvanic or corrosive action.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

Signs shall be installed at locations shown on the drawings. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs on doors or other surfaces shall not be installed until finishes on such surfaces have been installed.

##### **3.1.1 Anchorage**

Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood.

##### **3.1.2 Protection and Cleaning**

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with the manufacturer's approved instructions.

ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-98-B-0040

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SECTION 15330

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

**PART**

**1 GENERAL**

**1.1 REFERENCES**

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- \-ASTM A 47-\ (1990) Ferritic Malleable Iron Castings
- \-ASTM A 53-\ (1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
- \-ASTM A 135-\ (1993) Electric-Resistance-Welded Steel Pipe
- \-ASTM A 183-\ (1983; R 1990) Carbon Steel Tract Bolts and Nuts
- \-ASTM A 536-\ (1984; R 1993) Ductile Iron Castings
- \-ASTM A 795-\ (1995) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- \-ASME B16.1-\ (1989) Cast Iron Pipe Flanges and Flanged Fittings
- \-ASME B16.3-\ (1992) Malleable Iron Threaded Fittings
- \-ASME B16.4-\ (1992) Cast Iron Threaded Fittings
- \-ASME B16.9-\ (1993) Factory-Made Wrought Steel Buttwelding Fittings
- \-ASME B16.11-\ (1991) Forged Fittings, Socket-Welding and Threaded
- \-ASME B18.2.1-\ (1981; Supple 1991; R 1992) Square and Hex Bolts and Screws (Inch Series)
- \-ASME B18.2.2-\ (1987; R 1993) Square and Hex Nuts (Inch Series)

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-98-B-0040

\-ASSE 1015-\ (1993) Double Check Backflow Prevention Assembly

AMERICAN WATER WORKS ASSOCIATION (AWWA)

\-AWWA-10062JU-\ (1992) Standard Methods for the Examination of Water and Wastewater

\-AWWA B300-\ (1992) Hypochlorites

\-AWWA B301-\ (1992) Liquid Chlorine

\-AWWA C104-\ (1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

\-AWWA C110-\ (1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids

\-AWWA C111-\ (1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

\-AWWA C151-\ (1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

\-AWWA C203-\ (1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

\-AWWA M20-\ (1973) Manual: Water Chlorination Principles and Practices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

\-FM P7825-\ (1995; Supple I; Supple II; Supple III) Approval Guide

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

\-MSS SP-71-\ (1990) Cast Iron Swing Check Valves, Flanges and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 13-\ (1994) Installation of Sprinkler Systems

\-NFPA 24-\ (1995) Installation of Private Fire Service Mains and Their Appurtenances

\-NFPA 1963-\ (1993) Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

\-NICET 1014-\ (1995) Program Detail Manual for Certification in the Field of Fire Protection

Engineering Technology (Field Code 003)  
Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

\-UL-01-\ (1996) Building Materials Directory  
\-UL-04-\ (1996; Supple) Fire Protection Equipment  
Directory  
\-UL 668-\ (1989; Rev Feb 1994) Hose Valves For Fire  
Protection Service

## 1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided in all areas of the building. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with \-NFPA 13-\ . Pipe sizes which are not indicated on drawings shall be determined by hydraulic calculation.

### 1.2.1 Hydraulic Design

The system shall be hydraulically designed to discharge a minimum density gpm per square foot over the hydraulically most demanding 3,000 square feet of floor area. The minimum density shall be as shown on plans. The minimum pipe size for branch lines in gridded systems shall be 1-1/4 inch. Hydraulic calculations shall be in accordance with the Area/Density Method of \-NFPA 13-\ .

#### 1.2.1.1 Hose Demand

An allowance for exterior hose streams of 500 gpm shall be added to the sprinkler system demand at the fire hydrant shown on the drawings closest to the point where the water service enters the building.

#### 1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 48 psi, and a flow of 944 gpm at a residual pressure of 32 psi. Water supply shall be presumed available at the point of connection of the fire service line to the looped water distribution main. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping.

### 1.2.2 Sprinkler Spacing

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed limits specified in \-NFPA 13-\ for light or ordinary hazard occupancies.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only.

Submittals related to system configuration, hydraulic calculations, and equipment selection, including manufacturer's catalog data, working drawings, connection drawings, control diagrams and certificates shall be submitted concurrently as a complete package. The package will be reviewed by the U.S. Army Engineer District Fire Protection Engineer. The following shall be submitted in accordance with Section \=01330=\ SUBMITTAL PROCEDURES:

\\*SD-01 Data\*\

\\*Sprinkler System Equipment\*\; \\*GA\*\.

Manufacturer's Catalog Data for each separate piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list which includes equipment description, model number and quantity shall be provided.

\\*Hydraulic Calculations\*\; \\*GA\*\.

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments.

\\*Spare Parts\*\; \\*FIO\*\.

Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

\\*SD-04 Drawings\*\

\\*Sprinkler System Shop Drawings\*\; \\*GA\*\.

Detail drawings conforming to the requirements established for working plans as prescribed in \-NFPA 13-\. Drawings shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

- a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.
- b. Floor plans drawn to a scale not less than 1/8" = 1'-0" which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.
- c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls

to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

\\*As-Built Drawings\*\; \\*FIO\*\.

As-built drawings, no later than 14 working days after completion of the Final Tests. The sprinkler system shop drawings shall be updated to reflect as-built conditions after work is completed and shall be on reproducible full-size mylar film.

\\*SD-06 Instructions\*\

\\*Test Procedures\*\; \\*GA\*\.

Proposed test procedures for piping hydrostatic test, testing of alarms, at least 14 days prior to the start of related testing.

\\*SD-07 Schedules\*\

\\*Preliminary Tests\*\; \\*GA\*\.

A schedule of preliminary tests, at least 14 days prior to the proposed start of the tests.

\\*Final Test\*\; \\*GA\*\.

Upon successful completion of tests specified under PRELIMINARY TESTS, written notification shall be given to the Contracting Officer of the date for the final acceptance test. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

\\*SD-08 Statements\*\

\\*Installer Qualifications\*\; \\*GA\*\.

Qualifications of the sprinkler installer.

\\*Submittal Preparer's Qualifications\*\; \\*GA\*\.

The name and documentation of certification of the individual who will prepare the submittals, prior to the submittal of the drawings and hydraulic calculations.

\\*SD-13 Certificates\*\

\\*Contractor's Material & Test Certificates\*\; \\*FIO\*\.

Certificates, as specified in \-NFPA 13-\, shall be completed and signed by the Contractor's Representative performing required tests for both underground and aboveground piping.

\\*SD-19 Operation and Maintenance Manuals\*\

\\*Sprinkler System\; \\*FIO\*\.

Manuals shall be in loose-leaf binder format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. The manuals shall list routine maintenance procedures possible breakdowns, and repairs, and troubleshooting guide. This shall include procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

#### 1.4 \\*HYDRAULIC CALCULATIONS\*\

Hydraulic calculations shall be as outlined in \-NFPA 13-\ except that calculations shall be performed by computer using software specifically designed for fire protection system design. Software which uses k-factors for typical branch lines is not acceptable. Calculations shall be taken back to the water supply source unless water supply data is otherwise indicated. Calculations shall substantiate that the design area indicated is the hydraulically most demanding. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

#### 1.5 \\*SUBMITTAL PREPARER'S QUALIFICATIONS\*\

The sprinkler system submittals, including as-built drawings, shall be prepared by an individual who is either a registered professional engineer or who is certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with \-NICET 1014-\.

#### 1.6 \\*INSTALLER QUALIFICATIONS\*\

The installer shall be experienced and regularly engaged in the installation of the type and complexity of system included in this project. A statement prior to submittal of any other data or drawings, that the

proposed sprinkler system installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the location of at least three systems recently installed by the proposed installer which are comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

#### **1.7 REGULATORY REQUIREMENTS**

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. Applicable material and installation standards referenced in Appendix A of \-NFPA 13-\ and \-NFPA 24-\ shall be considered mandatory the same as if such referenced standards were specifically listed in this specification. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. All requirements that exceed the minimum requirements of \-NFPA 13-\ shall be incorporated into the design. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

#### **1.8 DELIVERY AND STORAGE**

Equipment placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust or other contaminants.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL EQUIPMENT REQUIREMENTS**

##### **2.1.1 Standard Products**

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

##### **2.1.2 Requirements for Fire Protection Service**

Equipment and materials shall have been tested by Underwriters Laboratories, Inc. and listed in UL-04 or approved by Factory Mutual and listed in \-FM P7825-\ . Where the terms "listed" or "approved" appear in this specification, such shall mean listed in \-UL-04-\ or \-FM P7825-\ .

##### **2.1.3 Nameplates**

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

#### **2.2 UNDERGROUND PIPING SYSTEMS**

##### **2.2.1 Pipe**

Piping from a point 6 inches above the floor to a point 5 feet outside the building wall shall be ductile iron with a rated working pressure of 175 psi conforming to \-AWWA C151-\, with cement mortar lining conforming to \-AWWA C104-\. Piping more than 5 feet outside the building walls shall comply with Section \=02660=\ WATER LINES.

### **2.2.2 Fittings and Gaskets**

Fittings shall be ductile iron conforming to \-AWWA C110-\. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to \-AWWA C111-\.

### **2.2.3 Gate Valve and Indicator Posts**

Gate valves for underground installation shall be of the inside screw type with counter-clockwise rotation to open. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post of a length to permit the top of the post to be located 3 feet above finished grade. Gate valves and indicator posts shall be listed in \-UL-04-\ or \-FM P7825-\.

## **2.3 ABOVEGROUND PIPING SYSTEMS**

Aboveground piping shall be steel.

### **2.3.1 Steel Piping System**

#### **2.3.1.1 Steel Pipe**

Except as modified herein, steel pipe shall be black as permitted by \-NFPA 13-\ and shall conform to applicable provisions of \-ASTM A 795-\, \-ASTM A 53-\, or \-ASTM A 135-\. Pipe in which threads or grooves are cut shall be Schedule 40 or shall be listed by Underwriters' Laboratories to have a corrosion resistance ratio (CRR) of 1.0 or greater after threads or grooves are cut. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

#### **2.3.1.2 Fittings for Non-Grooved Steel Pipe**

Fittings shall be cast iron conforming to \-ASME B16.4-\, steel conforming to \-ASME B16.9-\ or \-ASME B16.11-\, or malleable iron conforming to \-ASME B16.3-\. Steel press fittings shall be approved for fire protection systems. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used.

#### **2.3.1.3 Grooved Mechanical Joints and Fittings**

Joints and fittings shall be designed for not less than 175 psi service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to \-ASTM A 47-\, Grade 32510; ductile iron conforming to \-ASTM A 536-\, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe.

Nuts and bolts shall be heat-treated steel conforming to \-ASTM A 183-\ and shall be cadmium plated or zinc electroplated.

#### **2.3.1.4 Flanges**

Flanges shall conform to \-NFPA 13-\ and \-ASME B16.1-\ . Gaskets shall be non-asbestos compressed material in accordance with \-ASME B16.21-\ , 1/16 inch thick, and full face or self-centering flat ring type. Bolts shall be squarehead conforming to \-ASME B18.2.1-\ and nuts shall be hexagon type conforming to \-ASME B18.2.2-\ .

#### **2.3.2 Pipe Hangers**

Hangers shall be listed in \-UL-04-\ or \-FM P7825-\ and of the type suitable for the application, construction, and pipe type and sized involved.

#### **2.3.3 Valves**

##### **2.3.3.1 Control Valve and Gate Valve**

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in \-UL-01-\ or \-FM P7825-\ . Butterfly type valves are not acceptable.

##### **2.3.3.2 Check Valve**

Check valve 2 inches and larger shall be listed in \-UL-01-\ or \-FM P7825-\ . Check valves 4 inches and larger shall be of the swing type with flanged cast iron body and flanged inspection plates, shall have a clear waterway and shall meet the requirements of \-MSS SP-71-\ , for Type 3 or 4.

[AM#006]

#### **2.4 Not Used**

[AM#006]

#### **2.5 Not Used**

#### **2.6 ALARM INITIATING AND SUPERVISORY DEVICES**

##### **2.6.1 Sprinkler Waterflow Indicator Switch, Vane Type**

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 10 gpm or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall include two SPDT (Form C) contacts, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture.

##### **2.6.2 Valve Supervisory (Tamper) Switch**

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

## **2.7 FIRE DEPARTMENT CONNECTION**

Fire department connection shall be projecting type for the central energy plant and a free standing connection for the instruction building. Each shall have cast brass body, matching wall escutcheon lettered "Auto Spkr" with a chromium plated finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 2-1/2 inch diameter American National Fire Hose Connection Screw Threads (NH) per \-NFPA 1963-\.

## **2.8 SPRINKLERS**

Sprinklers shall be used in accordance with their listed spacing limitations. Temperature classification shall be ordinary in the instruction building and intermediate in the central energy plant. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters shall have temperature classification in accordance with \-NFPA 13-\.

### **2.8.1 Upright Sprinkler**

Upright sprinkler shall be chrome-plated and shall have a nominal 1/2 inch or 17/32 inch orifice.

### **2.8.2 Pendent Sprinkler**

Pendent sprinkler shall be of the fusible strut or glass bulb type, recessed type with nominal 1/2 inch or 17/32 inch orifice. Pendent sprinklers shall have a polished chrome finish.

### **2.8.3 Sidewall Sprinkler**

Sidewall sprinkler shall have a nominal 1/2 inch orifice. Sidewall sprinkler shall have a polished chrome finish. Sidewall sprinkler shall be the quick-response type.

## **2.9 DISINFECTING MATERIALS**

### **2.9.1 Liquid Chlorine**

Liquid chlorine shall conform to \-AWWA B301-\.

### **2.9.2 Hypochlorites**

Calcium hypochlorite and sodium hypochlorite shall conform to \-AWWA B300-\.

## **2.10 ACCESSORIES**

### **2.10.1 Sprinkler Cabinet**

Spare sprinklers shall be provided in accordance with \-NFPA 13-\ and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

**2.10.2 Pendent Sprinkler Escutcheon**

Escutcheon shall be one-piece metallic type with a depth of less than 3/4 inch and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

**2.10.3 Pipe Escutcheon**

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw.

**2.10.4 Sprinkler Guard**

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located as indicated.

**2.10.5 Identification Sign**

Valve identification sign shall be minimum 6 inches wide x 2 inches high with enamel baked finish on minimum 18 gauge steel or 0.024 inch aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

**2.11 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY**

Double-check backflow prevention assembly shall comply with \-ASSE 1015-\ . The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 175 psi. The maximum pressure loss shall be 6 psi at a flow rate equal to the sprinkler water demand, at the location of the assembly.

**PART 3 EXECUTION**

**3.1 INSTALLATION REQUIREMENTS**

The installation shall be in accordance with the applicable provisions of \-NFPA 13-\, \-NFPA 24-\ and publications referenced therein.

**3.2 ABOVEGROUND PIPING INSTALLATION**

Piping shall be run straight and bear evenly on hangers and supports.

### **3.2.1 Piping in Exposed Areas**

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

### **3.2.2 Piping in Finished Areas**

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

### **3.2.3 Pendent Sprinklers**

Drop nipples to pendent sprinklers shall consist of minimum 1 inch pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 12 inches. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling shall not extend more than 1 inch below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 4 inches. Recessed pendent sprinklers shall be installed such that the distance from the sprinkler deflector to the underside of the ceiling shall not exceed the manufacturer's listed range and shall be of uniform depth throughout the finished area.

#### **3.2.3.1 Pendent Sprinkler Locations**

Pendent sprinklers in suspended ceilings shall be a minimum of 6 inches from ceiling grid.

### **3.2.4 Upright Sprinklers**

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 30 inches in length shall be individually supported.

### **3.2.5 Pipe Joints**

Pipe joints shall conform to \-NFPA 13-\, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by \-NFPA 13-\ at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by \-NFPA 13-\. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

### **3.2.6 Reducers**

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2 inch.

### **3.2.7 Pipe Penetrations**

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section 7270 FIRESTOPPING. In penetrations which are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement which will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

### **3.2.8 Escutcheons**

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

### **3.2.9 Inspector's Test Connection**

Unless otherwise indicated, test connection shall consist of 1 inch pipe connected to the remote branch line; a test valve located approximately 7 feet above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

### **3.2.10 Drains**

Main drain piping shall be provided to discharge at the locations indicated. Auxiliary drains shall be provided as required by NFPA 13 except that drain valves shall be used where drain plugs are otherwise permitted. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line.

### **3.2.11 Installation of Fire Department Connection**

Connection shall be mounted on the exterior wall approximately 3 feet above dock floor for central energy plant and as shown for instruction building.

The piping between the connection and the check valve shall be provided with an automatic drip in accordance with \-NFPA 13-\ and arranged to drain to the outside.

### **3.2.12 Identification Signs**

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by \-NFPA 13-\ . Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in \-NFPA 13-\ .

### **3.3 UNDERGROUND PIPING INSTALLATION**

The fire protection water main shall be laid, and joints anchored, in accordance with \-NFPA 24-\ . Minimum depth of cover shall be 3 feet. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 6 inches above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with \-NFPA 24-\ using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with \-AWWA C203-\ . Piping more than 5 feet outside the building walls shall meet the requirements of Section \=02660=\ WATER LINES.

### **3.4 EARTHWORK**

Earthwork shall be performed in accordance with applicable provisions of Section \=02221=\ EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

### **3.5 ELECTRICAL WORK**

Alarm signal wiring connected to the building fire alarm control system shall be in accordance with Section \=16721=\ FIRE DETECTION AND ALARM SYSTEM. Wiring color code shall remain uniform throughout the system.

### **3.6 STERILIZATION**

After system components have been installed and pressure tested, each portion of the completed system shall be sterilized. After pressure tests have been made, the portion to be sterilized shall be thoroughly flushed with water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with \-AWWA M20-\ . The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump, shall be used. Chlorination application shall continue until the entire system is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour

period, no less than 25 ppm chlorine residual shall remain in the system. The system shall be then flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in properly sterilized containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer. Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with -AWWA-10062JU-. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The sterilization shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

### **3.7 FIELD PAINTING AND FINISHING**

Field painting and finishing are specified in Section \=09900=\ PAINTING, GENERAL.

### **3.8 PRELIMINARY TESTS**

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with \-NFPA 13-\ and \-NFPA 24-\ . Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS.

#### **3.8.1 Underground Piping**

##### **3.8.1.1 Flushing**

Underground piping shall be flushed in accordance with \-NFPA 24-\ . This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less than the calculated maximum water demand rate of the system.

##### **3.8.1.2 Hydrostatic Testing**

New underground piping shall be hydrostatically tested in accordance with \-NFPA 24-\ . The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 2 quarts per hour per 100 gaskets or joints, regardless of pipe diameter.

#### **3.8.2 Aboveground Piping**

##### **3.8.2.1 Hydrostatic Testing**

Aboveground piping shall be hydrostatically tested in accordance with \-NFPA 13-\ at not less than 200 psi or 50 psi in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall

be read from a gauge located at the low elevation point of the system or portion being tested.

**3.8.3 Testing of Alarm Devices**

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

**3.8.4 Main Drain Flow Test**

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

**3.9 FINAL ACCEPTANCE TEST**

A technician employed by the installing Contractor shall be present for the final tests and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

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SECTION 16415

ELECTRICAL WORK, INTERIOR

08/96

**PART**

**1 - GENERAL**

**1.1 REFERENCES**

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI C12.1-\	(1995) Code for Electricity Metering
\-ANSI C12.4-\	(1984; R 1996) Mechanical Demand Registers
\-ANSI C12.10-\	(1987) Electromechanical Watthour Meters
\-ANSI C12.11-\	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL Through 350 kV BIL (0.6 kV NSV Through 69 kV NSV)
\-ANSI C37.16-\	\&(1988; C37.16a; R 1995)&\ Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations
\-ANSI C39.1-\	(1981; R 1992) Requirements for Electrical Analog Indicating Instruments
\-ANSI C57.12.10-\	(1987) Safety Requirements for Transformers 230 kV and Below 833/958 Through 8333/10417 kVA, Single-Phase, and 750/862 Through 60 000/80 000/100 000 kVA, Three-Phase Without Load Tap Charging; and 3750/4687 Through 60 000/80 000/100 000 kVA With Load Tap Charging
\-ANSI C57.12.13-\	(1982) Conformance Requirements for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations
\-ANSI C57.12.27-\	(1982) Conformance Requirements for Liquid-Filled Distribution Transformers Used in Pad-Mounted Installations, Including Unit Substations
\-ANSI C57.12.50-\	(1981; R 1989) Ventilated Dry-type Distribution Transformers 1 to 500 kVA, Single-Phase; and 15 to 500 kVA, Three-Phase with High-Voltage 601 to 34 500 Volts, Low-Voltage 120 to 600 Volts

ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-98-B-0040

- \-ANSI C57.12.51-\ (1981; R 1989) Ventilated Dry-Type Power Transformers, 501 kVA and Larger, Three-Phase, with High-Voltage 601 to 34 500 Volts, Low-Voltage 208Y/120 to 4160 Volts
- \-ANSI C57.12.52-\ (1981; R 1989) Sealed Dry-Type Power Transformers, 501 kVA and Larger, Three-Phase with High-Voltage 601 to 34 500 Volts, Low-Voltage 208Y/120 to 4160 Volts
- \-ANSI C57.12.70-\ (1978; R 1993) Terminal Markings and Connections for Distribution and Power Transformers
- \-ANSI C80.5-\ \&(1995)&\ Rigid Aluminum Conduit
- \-ANSI C82.1-\ (1985; C82.1a; C82.1b; C82.1c; R 1992) Specifications for Fluorescent Lamp Ballasts
- \-ANSI C82.4-\ (1992) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
- \-ANSI C135.30-\ (1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- \-ASTM B 1-\ (1990) Hard-Drawn Copper Wire
- \-ASTM B 8-\ (1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- \-ASTM D 709-\ (1992) Laminated Thermosetting Materials
- \-ASTM D 4059-\ (1991) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography

CODE OF FEDERAL REGULATIONS (CFR)

- \-47 CFR 18-\ Industrial, Scientific, and Medical Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- \-IEEE C2-\ (1997) National Electrical Safety Code
- \-IEEE C37.13-\ \&(1990; R 1995)&\ Low-Voltage AC Power Circuit Breakers Used in Enclosures
- \-IEEE C37.20.1-\ (1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
- \-IEEE C57.12.00-\ (1993) IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

\-IEEE C57.12.80-\ (1978; R 1992) Terminology for Power and Distribution Transformers

\-IEEE C57.12.90-\ (1993) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers

\&\-IEEE ANSI/IEEE C57.13-\&\ (1993) Instrument Transformers

\-IEEE C57.98-\ (1993) Guide for Transformer Impulse Tests

\-IEEE C57.100-\ (1986; R 1992) Test Procedure for Thermal Evaluation of Oil-Immersed Distribution Transformers

\-IEEE C62.41-\ (1991) Surge Voltages in Low-Voltage AC Power Circuits

\-IEEE Std 81-\ (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)

\-IEEE Std 242-\ (1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

\-IEEE Std 399-\ (1990) \&Recommended Practice for Industrial and Commercial Power Systems Analysis&\

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

\-NEMA 250-\ (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

\-NEMA AB 1-\ (1993) Molded Case Circuit Breakers and Molded Case Switches

\-NEMA BU 1-\ (1994) Busways

\-NEMA FU 1-\ (1986) Low Voltage Cartridge Fuses

\-NEMA ICS 1-\ (1993) Industrial Control and Systems

\-NEMA ICS 2-\ (1993) Industrial Control and Systems Controllers, Contactors, Overload Relays Rated Not More Than 2,000 Volts AC or 750 DC

\-NEMA ICS 3-\ (1993) \&Industrial Control and Systems Factory Built Assemblies&\

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\-NEMA ICS 6-\ (1993) Industrial Control and Systems Enclosures

\-NEMA LE 4-\ (1987) Recessed Luminaires, Ceiling Compatibility

\-NEMA MG 1-\ \&(1993; Rev 1; Rev 2; Rev 3)\ Motors and Generators

\-NEMA MG 10-\ (1994) Energy Management Guide for Selection and Use of Polyphase Motors

\-NEMA OS 1-\ (1989) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

\-NEMA OS 2-\ (1986; Errata Aug 1986; R 1991) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports

\-NEMA PB 1-\ (1990) Panelboards

\-NEMA PB 2-\ \&(1995)\ Deadfront Distribution Switchboards

\-NEMA PE 5-\ (1985; R 1991) Utility Type Battery Chargers

\-NEMA RN 1-\ (1989) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

\-NEMA SG 3-\ \&(1995)\ Low-Voltage Power Circuit Breakers

\-NEMA ST 20-\ (1992) Dry-Type Transformers for General Applications

\-NEMA TC 2-\ (1990) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)

\-NEMA TC 13-\ (1993) Electrical Nonmetallic Tubing (ENT)

\-NEMA VE 1-\ (1991) \&Metal Cable Tray Systems&\

\-NEMA WD 1-\ (1983; R 1989) General Requirements for Wiring Devices

\-NEMA WD 6-\ (1988) Wiring Devices - Dimensional Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 70-\ (1996) National Electrical Code

\-NFPA 101-\ \&(1997)\ Safety to Life from Fire in Buildings and Structures

UNDERWRITERS LABORATORIES (UL)

\-UL-03-\                    \&(1996; Supple)&\ Electrical Construction  
Materials Directory

\-UL 1-\                    (1993; Rev thru Jan 1995) Flexible Metal  
Conduit

\-UL 4-\                    (1986; Rev thru Nov 1990) Armored Cable

\-UL 5-\                    (1995) Surface Metal Raceways and Fittings

\-UL 6-\                    \&(1993; Rev Mar 1996)&\ Rigid Metal Conduit

\-UL 20-\                   \&(1995; Rev thru Apr 1997)&\ General-Use Snap  
Switches

\-UL 44-\                   \&(1997) Thermoset-Insulated Wires and  
Cables&\

\-UL 50-\                   \&(1995; Rev Oct 1996)&\ Enclosures for  
Electrical Equipment

\-UL 67-\                   (1993; Rev thru Dec 1993) Panelboards

\-UL 83-\                   \&(1996)&\ Thermoplastic-Insulated Wires and  
Cables

\-UL 98-\                   (1994; R Oct 1995) Enclosed and Dead-Front  
Switches

\-UL 198B-\                   (1995) Class H Fuses

\-UL 198C-\                   (1986; Rev thru Jun 1993)  
High-Interrupting-Capacity Fuses,  
Current-Limiting Types

\-UL 198D-\                   (1995) Class K Fuses

\-UL 198E-\                   (1988; Rev Jul 1988) Class R Fuses

\-UL 198G-\                   (1988; Rev May 1988) Fuses for Supplementary  
Overcurrent Protection

\-UL 198H-\                   (1988; Rev thru Nov 1993) Class T Fuses

\-UL 198L-\                   (1995; Rev May 1995) D-C Fuses for Industrial  
Use

\-UL 360-\                   \&(1996; Rev Mar 1997)&\ Liquid-Tight Flexible  
Steel Conduit

- \-UL 467-\ (1993; Rev thru Aug 1996) Grounding and Bonding Equipment
- \-UL 486A-\ (1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
- \-UL 486B-\ \&(1997)\ Wire Connectors for Use with Aluminum Conductors
- \-UL 486C-\ \&(1997)\ Splicing Wire Connectors
- \-UL 486E-\ \&(1994; Rev thru Feb 1997)\ Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
- \-UL 489-\ \&(1996; Rev May 1997) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures\
- \-UL 498-\ \&(1996)\ Attachment Plugs and Receptacles
- \-UL 506-\ (1994; Rev Jul 1994) Specialty Transformers
- \-UL 508-\ (1993) Industrial Control Equipment
- \-UL 510-\ (1994) Insulating Tape
- \-UL 512-\ (1993; R Dec 1995) Fuseholders
- \-UL 514A-\ \&(1996)\ Metallic Outlet Boxes
- \-UL 514B-\ \&(1996)\ Fittings for Conduit and Outlet Boxes
- \-UL 514C-\ \&(1996)\ Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
- \-UL 542-\ \&(1994; Rev May 1997)\ Lampholders, Starters, and Starter Holders for Fluorescent Lamps
- \-UL 651-\ \&(1995; Rev Jan 1997)\ Schedule 40 and 80 Rigid PVC Conduit
- \-UL 651A-\ \&(1995; Rev Sep 1996)\ Type EB and A Rigid PVC Conduit and HDPE Conduit
- \-UL 674-\ \&(1994; Rev thru Feb 1997)\ Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations

- \-UL 698-\ \&(1995; Rev thru Dec 1996)&\ Industrial Control Equipment for Use in Hazardous (Classified) Locations
- \-UL 719-\ (1996) Nonmetallic-Sheathed Cables
- \-UL 797-\ \&(1993; Rev thru Mar 1997)&\ Electrical Metallic Tubing
- \-UL 817-\ \&(1994; Rev thru Feb 1997)&\ Cord Sets and Power-Supply Cords
- \-UL 844-\ (1995; Rev thru Aug 1996) Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
- \-UL 845-\ (1995; Rev Feb 1996) Motor Control Centers
- \-UL 854-\ \&(1996; Rev May 1996)&\ Service-Entrance Cables
- \-UL 857-\ \&(1994; Rev thru Nov 1996)&\ Busways and Associated Fittings
- \-UL 869A-\ (1993; Rev Apr 1994) Reference Standard for Service Equipment
- \-UL 877-\ (1993; Rev Jul 1995) Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous (Classified) Locations
- \-UL 886-\ \&(1994; Rev thru Jan 1997)&\ Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
- \-UL 891-\ (1994; Rev thru Jan 1995) Dead-Front Switchboards
- \-UL 924-\ \&(1995; Rev thru May 95)&\ Emergency Lighting and Power Equipment
- \-UL 935-\ \&(1995; Rev thru Apr 1997)&\Fluorescent-Lamp Ballasts
- \-UL 943-\ \&(1993; Rev thru Mar 1997)&\Ground-Fault Circuit Interrupters
- \-UL 1004-\ \&(1994; Rev thru Feb 1997)&\ Electric Motors
- \-UL 1010-\ \&(1995; Rev thru Dec 1996)&\Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations

- \-UL 1022-\ (1994) Line Isolation Monitors
- \-UL 1029-\ (1994; Rev Sep 1995) High-Intensity-Discharge Lamp Ballasts
- \-UL 1047-\ (1995) Isolated Power Systems Equipment
- \-UL 1236-\ (1994; Rev thru Apr 1996) Battery Chargers for Charging Engine-Starter Batteries
- \-UL 1242-\ \&(1996)&\ Intermediate Metal Conduit
- [AM#1]
- \-UL 1449-\ (1998; Second Edition) Transient Voltage Surge Suppressors
- \-UL 1564-\ (1993; Rev Apr 1994) Industrial Battery Chargers
- \-UL 1569-\ (1995) Metal-Clad Cables
- \-UL 1570-\ (1995) Fluorescent Lighting Fixtures
- \-UL 1571-\ (1991; Rev thru Mar 95) Incandescent Lighting Fixtures
- \-UL 1572-\ (1995; Rev thru Sep 96) High Intensity Discharge Lighting Fixtures
- \-UL 1660-\ (1994) Liquid-Tight Flexible Nonmetallic Conduit

## 1.2 GENERAL

### 1.2.1 Rules

The installation shall conform to the requirements of \-NFPA 70-\ and \-NFPA 101-\, unless more stringent requirements are indicated herein or shown.

### 1.2.2 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment shall be properly located and readily accessible. Lighting fixtures, outlets, and other equipment and materials shall be located to avoid interference with mechanical or structural features; otherwise, lighting fixtures shall be symmetrically located according to the room arrangement when uniform illumination is required, or asymmetrically located to suit conditions fixed by design and shown. Raceways, junction and outlet boxes, and lighting fixtures shall not be supported from sheet metal roof decks. If any conflicts occur necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.

The Contractor shall coordinate electrical work with the HVAC and electrical drawings and specifications and provide power related wiring.

**1.2.3 Special Environments**

**1.2.3.1 Weatherproof Locations**

Wiring, Fixtures, and equipment in designated locations shall conform to \-NFPA 70-\ requirements for installation in damp or wet locations.

**1.2.4 Standard Products**

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

**1.2.5 NAMEPLATES**

**1.2.5.1 Identification Nameplates**

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, identification nameplates shall be made of laminated plastic in accordance with \-ASTM D 709-\ with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except motors, or approved nonadhesive metal fasteners. When the nameplate is to be installed on an irregular-shaped object, the Contractor shall devise an approved support suitable for the application and ensure the proper installation of the supports and nameplates. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic. The front of each panelboard, motor control center, switchgear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

\~	Minimum 1/4 inch High Letters	Minimum 1/8 inch High Letters
	Panelboards	Control Power Transformers
	Starters	Control Devices
	Safety Switches	Instrument Transformers
	Transformers	
	Equipment Enclosures	
	Switchgear	
	Switchboards	
	Motors~\	

Each panel, section, or unit in switchgear or similar assemblies shall be provided with a nameplate in addition to nameplates listed above, which shall be provided for individual compartments in the respective assembly, including

nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

### 1.2.6 As-Built Drawings

Following the project completion or turnover, within 30 days the Contractor shall furnish two sets of as-built drawings to the Contracting Officer.

[AM#1]

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section \=01330=\ SUBMITTAL PROCEDURES:

\\*SD-01 Data\*\

—

\\*Manufacturer's Catalog\*\; \\*FIO\*\.

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

\\*Material, Equipment, and Fixture Lists\*\; \\*FIO\*\.

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

\\*Installation Procedures\*\; \\*FIO\*\.

Installation procedures for rotating equipment, transformers, switchgear, battery systems, voltage regulators, and grounding resistors. Procedures shall include diagrams, instructions, and precautions required to install, adjust, calibrate, and test devices and equipment.

[AM#6]

\\*Harmonic Mitigating Transformers\*\; \\*GA\*\.

Catalog data shall include data indicating compliance with all parameters indicated by the contract documents. Quantitative performance data including before/after effect on voltage distortion at load panels that demonstrates the capability to achieve the specified harmonic treatment shall be submitted for approval per SD-09 Reports. Data shall indicate the applicable UL Standard and UL control number. Manufacturer shall provide a minimum of two references of prior installations to indicate compliance with the two year requirement of paragraph "Standard Products". References shall include company names, addresses, and date of purchase. Point of contact for company references shall be furnished for verification.

\\*SD-04 Drawings\*\

\\*Interior Electrical Equipment\*\; \\*FIO\*\.

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

- a. Transformers.
- b. Switchgear.
- c. Battery system including calculations for the battery and charger.
- d. Harmonic mitigating transformers.
- e. Grounding resistors.
- f. Motors and rotating machinery.
- g. Service Modules.
- h. Single line electrical diagrams including primary, metering, sensing and relaying, control wiring, and control logic.
- h. Sway bracing for suspended luminaires.

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

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

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

\\*As-Built Drawings\*\; \\*FIO\*\.

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

\\*SD-08 Statements\*\

\\*On-Site Test\*\; \\*GA\*\.

A detailed description of the Contractor's proposed procedures for on-site tests.

\\*SD-09 Reports\*\

\\*Factory Test Reports\*\; \\*GA\*\.

Six copies of the information described below in ~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 equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.

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- d. The equipment and values to be verified.
- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.

\\*Field Test Plan\*\; \\*GA\*\.

A detailed description of the Contractor's proposed procedures for on-site test submitted 20 days prior to testing the installed system. No field test will be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

\\*Field Test Reports\*\; \\*GA\*\.

Six copies of the information described below in ~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 equipment used, with calibration certifications.
- b. A copy of measurements taken.
- c. The dates of testing.
- d. The equipment and values to be verified.
- e. The conditions specified for the test.
- f. The test results, signed and dated.
- g. A description of adjustments made.
- h. Final position of controls and device settings.

\\*SD-13 Certificates\*\

\\*Materials and Equipment\*\; \\*GA\*\.

The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted. However, materials and equipment installed in hazardous locations must bear the UL label unless the data submitted from other testing agency is specifically approved in writing by the Contracting Officer. Items which are required to be listed and labeled in accordance with Underwriters Laboratories must be affixed with a UL label that states that it is UL listed. No exceptions or waivers will be granted to this requirement. Materials and equipment will be approved based on the manufacturer's published data.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, or other commercial standard, is acceptable.

**1.4 WORKMANSHIP**

Materials and equipment shall be installed in accordance with \-NFPA 70-\, recommendations of the manufacturer, and as shown.

**PART 2 - PRODUCTS**

Products shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

**2.1 TV SYSTEMS**

**2.1.1 Coaxial Cable**

All coaxial cable used shall conform to NFPA 70. The coaxial cable shall have an outside diameter less than .5 inch and shall be PVC jacketed and shall have a braided copper or aluminum outer conductor with 65 plus or minus 5 percent braid coverage. The inner conductor shall be copper clad steel wire or solid copper and an aluminum foil bonded to the outside of the dielectric. The cable shall have a polyethylene foam dielectric. The cables shall be of the type RG-6. Its impedance shall be 75 plus or minus 2 ohms; capacitance shall be 17 picofarads per foot; and the velocity of propagation shall be 81 plus or minus 3 percent.

**2.1.2 Signal Splitter**

The cable distribution system shall utilize signal power splitters, directional couplers, and isolation taps as required to meet the system performance requirements. Signal splitters shall have a power throughput capability of 6 amperes minimum when amplifiers are to be powered through the cable. All signal splitters shall be contained in rugged weatherproof anodized aluminum or other noncorrosive metal housing with brass connector ports. In addition to the above specifications, the splitters shall as a minimum conform to the following specifications:

Impedance:	75 ohms unbalanced
Return Loss:	17 dB
RFI Shielding:	100 dB
Isolation:	25 dB

**2.1.3 Outlets**

Outlets with plates shall be wall mounted and shall not protrude from the face of the wall more than 1/4 inch. Each outlet shall have an attenuation of less than 0.1 dB and a VSWR of less than 1.15 to 1. Cable Connectors shall be 75

ohm Type "F" self-terminating units. All metallic portions of connectors shall be composed of anodized brass, beryllium copper or phosphorus bronze. Outlet connector shall be Type "F" female plug.

## **2.2 CABLES AND WIRES**

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. Conductors indicated to be No. 6 AWG or smaller diameter shall be copper. Conductors indicated to be No. 4 AWG and larger diameter shall be either copper or aluminum, unless otherwise indicated or required by manufacturer.

### **2.2.1 Equipment Manufacturer Requirements**

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to meet manufacturer's requirements.

### **2.2.2 Aluminum Conductors**

Aluminum conductors shall be AA-8000 series electrical grade aluminum alloy conductors. Type EC-1350 aluminum is unacceptable.

### **2.2.3 Insulation**

Unless indicated otherwise, or required by \-NFPA 70-\, power and lighting wires shall be 600-volt, Type THWN, THHN, or THW conforming to \-UL 83-\ or RHW conforming to \-UL 44-\, except that grounding wire may be type TW conforming to \-UL 83-\; remote-control and signal circuits shall be Type TW, THW or TF, conforming to \-UL 83-\. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

### **2.2.4 Bonding Conductors**

\-ASTM B 1-\, solid bare copper wire for sizes No. 8 AWG and smaller diameter; \-ASTM B 8-\, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

### **2.2.5 Service Entrance Cables**

Service entrance (SE) and underground service entrance (USE) cables, \-UL 854-\.

### **2.2.6 Flat Conductor Cable**

UL listed \-NFPA 70-\, type FCC.

### **2.2.7 Tray Cable or Power Limited Tray Cable**

UL listed; Type TC or PLTC.

### **2.2.8 Cord Sets and Power-Supply Cords**

\-UL 817-\.

### **2.3 CABLE TRAYS**

\-NEMA VE 1-\ cable trays shall form a wireway system, and shall be of nominal \~6 inch~\ depth. Cable trays shall be constructed of zinc-coated steel. Trays shall include splice and end plates, dropouts, and miscellaneous hardware. Edges, fittings, and hardware shall be finished free from burrs and sharp edges. Fittings shall have not less than the load-carrying ability of straight tray sections and shall have manufacturer's minimum standard radius. Radius of bends shall be \~12 inches.~\

#### **2.3.1 Ladder**

Ladder-type cable trays shall be of nominal \~18 inch~\ width. Rung spacing shall be on \~6 inch~\ maximum centers.

### **2.4 TRANSIENT VOLTAGE SURGE PROTECTION**

Transient voltage surge suppressors shall be provided as indicated. Surge suppressors shall meet the requirements of \-IEEE C62.41-\ and be UL listed and labeled as having been tested in accordance with \-UL 1449-\ . Surge suppressor ratings shall be as indicated. Fuses shall not be used as surge suppression.

### **2.5 CIRCUIT BREAKERS**

#### **2.5.1 MOLDED-CASE CIRCUIT BREAKERS**

Molded-case circuit breakers shall conform to \-NEMA AB 1-\ and \-UL 489-\ and \-UL 877-\ for circuit breakers and circuit breaker enclosures located in hazardous (classified) locations. Circuit breakers may be installed in panelboards, switchboards, enclosures, motor control centers, or combination motor controllers.

##### **2.5.1.1 Construction**

Circuit breakers shall be suitable for mounting and operating in any position. Lug shall be listed for copper and aluminum conductors in accordance with \-UL 486E-\ . Single-pole circuit breakers shall be full module size with not more than one pole per module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multi-pole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. All circuit breakers shall have a quick-make, quick-break overcenter toggle-type mechanism, and the handle mechanism shall be trip-free to prevent holding the contacts closed against a short-circuit or sustained overload. All circuit breaker handles shall assume a position between "ON" and "OFF" when tripped automatically. All ratings shall be clearly visible.

##### **2.5.1.2 Ratings**

Voltage ratings shall be not less than the applicable circuit voltage. The interrupting rating of the circuit breakers shall be at least equal to the available short-circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short-circuit current rating specified for the panelboards and switchboards. Molded-case circuit breakers shall have nominal voltage ratings, maximum continuous-current ratings, and maximum short-circuit interrupting ratings in accordance with \-NEMA AB 1-\. Ratings shall be coordinated with system X/R ratio.

**2.5.2 SWD Circuit Breakers**

Circuit breakers rated 15 amperes and intended to switch 277 volts or less fluorescent lighting loads shall be marked "SWD."

**2.5.3 HACR Circuit Breakers**

Circuit breakers 60 amperes or below, 240 volts, 1-pole or 2-pole, intended to protect multi-motor and combination-load installations involved in heating, air conditioning, and refrigerating equipment shall be marked "Listed HACR Type."

**2.5.4 Ground Fault Circuit Interrupters**

\-UL 943-\. Breakers equipped with ground fault circuit interrupters shall have ground fault class, interrupting capacity, and voltage and current ratings as indicated.

**2.6 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)**

Motor short-circuit protectors shall conform to \-UL 508-\ and shall be provided as shown. Protectors shall be used only as part of a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection, and shall be rated in accordance with the requirements of \-NFPA 70-\.

**2.6.1 Construction**

Motor short-circuit protector bodies shall be constructed of high temperature, dimensionally stable, long life, nonhygroscopic materials. Protectors shall fit special MSCP mounting clips and shall not be interchangeable with any commercially available fuses. Protectors shall have 100 percent one-way interchangeability within the A-Y letter designations. All ratings shall be clearly visible.

**2.6.2 Ratings**

Voltage ratings shall be not less than the applicable circuit voltage. Letter designations shall be A through Y for motor controller Sizes 0, 1, 2, 3, 4, and 5, with 100,000 amperes interrupting capacity rating. Letter designations shall correspond to controller sizes as follows:

CONTROLLER SIZE	MSCP DESIGNATION
NEMA 0	A-N
NEMA 1	A-P

NEMA 2	A-S
NEMA 3	A-U
NEMA 4	A-W
NEMA 5	A-Y

**2.7 CONDUIT AND TUBING**

**2.7.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)**

\-UL 797-\

**2.7.2 Electrical Nonmetallic Tubing (ENT)**

\-NEMA TC 13-\.

**2.7.3 Electrical Plastic Tubing and Conduit**

\-NEMA TC 2-\.

**2.7.4 Flexible Conduit, Steel and Plastic**

General-purpose type, \-UL 1-\; liquid tight, \-UL 360-\, and \-UL 1660-\.

**2.7.5 Intermediate Metal Conduit**

\-UL 1242-\.

**2.7.6 PVC Coated Rigid Steel Conduit**

\-NEMA RN 1-\.

**2.7.7 Rigid Aluminum Conduit**

\-ANSI C80.5-\ and \-UL 6-\.

**2.7.8 Rigid Metal Conduit**

\-UL 6-\.

**2.7.9 Rigid Plastic**

\-NEMA TC 2-\, \-UL 651-\ and \-UL 651A-\.

**2.7.10 Surface Metal Electrical Raceways and Fittings**

\-UL 5-\.

**2.8 CONDUIT AND DEVICE BOXES AND FITTINGS**

**2.8.1 Boxes, Metallic Outlet**

\-NEMA OS 1-\ and \-UL 514C-\.

**2.8.2 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers**

\-NEMA OS 2-\ and \-UL 514C-\.

**2.8.3 Boxes, Outlet for Use in Hazardous (Classified) Locations**

\-UL 886-\.

**2.8.4 Boxes, Switch (Enclosed), Surface-Mounted**

\-UL 98-\.

**2.8.5 Fittings for Conduit and Outlet Boxes**

\-UL 514B-\.

**2.8.6 Fittings For Use in Hazardous (Classified) Locations**

\-UL 886-\.

**2.8.7 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing**

\-UL 514B-\.

**2.9 CONDUIT COATINGS PLASTIC RESIN SYSTEM**

\-NEMA RN 1-\, Type A-40.

**2.10 CONNECTORS, WIRE PRESSURE**

**2.10.1 For Use With Copper Conductors**

\-UL 486A-\.

**2.10.2 For Use With Aluminum Conductors**

\-UL 486B-\.

**2.11 ELECTRICAL GROUNDING AND BONDING EQUIPMENT**

\-UL 467-\.

[AM#1]

**2.11.1 Ground Rods**

Ground rods shall be of copper-clad steel conforming to \-UL 467- not less than \~3/4 inch~\ in diameter by \~10 feet~\ in length of the sectional type driven full length into the earth.

**2.11.2 Ground Bus**

The ground bus shall be bare conductor or flat copper in one piece, if practicable.

**2.12 ENCLOSURES**

\-NEMA ICS 6-\ or \-NEMA 250-\ unless otherwise specified.

**2.12.1 Cabinets and Boxes**

Cabinets and boxes with volume greater than \~100 cubic inches~\ shall be in accordance with \-UL 50-\, hot-dip, zinc-coated, if sheet steel.

**2.12.2 Circuit Breaker Enclosures**

\-UL 489-\.

**2.13 FIXTURES, LIGHTING AND FIXTURE ACCESSORIES/COMPONENTS**

Standard Drawing 40-06-04 sheets referenced hereinafter and enclosed as an integral part of these specifications and additional fixtures shown on contract drawings, if any. Fixtures, accessories and components, including ballasts, lampholders, lamps, starters and starter holders, shall conform to industry standards specified below.

**2.13.1 Fixture, Auxiliary or Emergency**

\-UL 924-\.

**2.13.2 Incandescent Fixture**

\-NEMA LE 4-\ for ceiling compatibility of recessed fixtures and \-UL 1571-\.

**2.13.3 Fluorescent**

a. Fixture: \-NEMA LE 4-\ for ceiling compatibility of recessed fixtures and \-UL 1570-\ . Fixtures shall be plainly marked for proper lamp and ballast type to identify lamp diameter, wattage, color and start type. Marking shall be readily visible to service personnel, but not visible from normal viewing angles.

b. Ballasts:

(1) Electronic Ballast. Electronic ballasts shall consist of a rectifier, high frequency inverter, and power control and regulation circuitry. The ballasts shall be UL listed, Class P, with a Class A sound rating and shall contain no PCBs. Ballasts shall meet \-47 CFR 18-\ for electromagnetic interference and shall not interfere with the operation of other electrical equipment. Design shall withstand line transients per \-IEEE C62.41-\, Category A. Unless otherwise indicated, the minimum number of ballasts shall be used to serve each individual fixture, using one, two, three or four lamp ballasts. A single ballast may be used to serve multiple fixtures if they are continuous mounted, factory manufactured for that installation with an integral wireway, and are identically controlled.

(a) Light output regulation shall be +/- 10%.

(b) Voltage input regulation shall be +/- 10%.

(c) Lamp current crest factor shall be no more than 1.6.

- (d) Ballast factor shall be not less than 85% nor more than 100%, unless otherwise indicated.
- (e) A 60 Hz filter shall be provided. Flicker shall be no more than 10% with any lamp suitable for the ballast.
- (f) Ballast case temperature shall not exceed 25 degree Celsius rise above 40 degree Celsius ambient, when tested in accordance with \-UL 935-\.
- (g) Total harmonic distortion shall be in the range of 10-20%.
- (h) Power factor shall not be less than 0.95.
- (i) Ballasts shall operate at a frequency of 20 kHz or more.
- (j) Operating filament voltage shall be 2.5 to 4.5 volts.
- (k) Warranty. Three year full warranty including a \$10 labor allowance.
- (l) Ballast Efficacy Factor (BEF) shall be in accordance with the following table. Ballasts and lamps shall be matching rapid start or instant start as indicated on the following table. If 32W-F32-T8 lamps and ballasts are used, they must be either all rapid start or all instant start.

ELECTRONIC FLUORESCENT BALLAST EFFICACY FACTORS\*

LAMP TYPE	TYPE OF STARTER & LAMP	NOMINAL OPERATIONAL INPUT VOLTAGE	NUMBER OF LAMPS	MIN. BALLAST EFFICACY FACTOR
40W F40 T12	rapid start	120 or 277 V	1	2.3
			2	1.2
			3	0.8
			4	0.6
34W F40 T12	rapid start	120 or 277 V	1	2.6
			2	1.3
			3	1.0
			4	0.7
40W F40 T10	rapid start	120 or 277 V	1	2.2
			2	1.1
			3	0.8
32W F32 T8	rapid or instant start	120 or 277 V	1	2.4
			2	1.4
			3	1.0
			4	0.8

\*For ballasts not specifically designed for use with dimming controls

The BEF is calculated using the formula:

BEF = Ballast Factor (in percent) / Power Input

Where Power Input = Total Wattage of Combined Lamps and Ballasts.

c. Lampholders, Starters, and Starter Holders: \-UL 542-\.

#### **2.13.4 High-Intensity-Discharge**

a. Fixture: \-NEMA LE 4-\ for ceiling compatibility of recessed fixtures and \-UL 1572-\.

b. Ballasts: \-ANSI C82.4-\ for multiple supply types and \-UL 1029-\.

#### **2.14 LOW-VOLTAGE FUSES AND FUSEHOLDERS**

##### **2.14.1 Fuses, Low Voltage Cartridge Type**

\-NEMA FU 1-\.

##### **2.14.2 Fuses, High-Interrupting-Capacity, Current-Limiting Type**

Fuses, Class G, J, L and CC shall be in accordance with \-UL 198C-\.

##### **2.14.3 Fuses, Class K, High-Interrupting-Capacity Type**

\-UL 198D-\.

##### **2.14.4 Fuses, Class H**

\-UL 198B-\.

##### **2.14.5 Fuses, Class R**

\-UL 198E-\.

##### **2.14.6 Fuses, Class T**

\-UL 198H-\.

##### **2.14.7 Fuses for Supplementary Overcurrent Protection**

\-UL 198G-\.

##### **2.14.8 Fuseholders**

\-UL 512-\.

#### **2.15 INSTRUMENTS, ELECTRICAL INDICATING**

\-ANSI C39.1-\.

#### **2.16 MOTORS, AC, FRACTIONAL AND INTEGRAL**

Motors, ac, fractional and integral \~horsepower,\ \~500 hp\ and smaller shall conform to \-NEMA MG 1-\ and \-UL 1004-\ for motors; and \-NEMA MG 10-\ for energy management selection of polyphase motors.

##### **2.16.1 Rating**

The \~horsepower~\ rating of motors should be limited to no more than 125 percent of the maximum load being served unless a NEMA standard size does not fall within this range. In this case, the next larger NEMA standard motor size should be used.

**2.16.2 Motor Efficiencies**

All permanently wired polyphase motors of \~1 hp~\ or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of \~1 hp~\ or more with open, drip proof or totally enclosed fan cooled enclosures shall be high efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Motor Efficiencies		
HP	Std. Efficiency	High Efficiency
1	77.0	85.5
1.5	78.5	85.5
2	78.5	85.5
3	78.5	88.5
5	82.5	88.5
7.5	84.0	90.0
10	85.5	90.0
15	85.5	91.0
20	87.5	92.0
25	88.5	92.0
30	88.5	92.0
40	88.5	92.0
50	89.0	92.5
60	89.0	92.5
75	89.0	95.5
100	90.0	93.5
125	91.0	94.5
150	91.0	94.5
200	91.0	94.5
250	91.0	94.5
300	91.0	94.5
350	91.0	94.5
400	91.0	94.5
500	91.0	94.5~\

**2.17 MOTOR CONTROLS**

**2.17.1 General**

\-NEMA ICS 1-\, \-NEMA ICS 2-\, \-NEMA ICS 3-\ and \-NEMA ICS 6-\, and \-UL 508-\ and \-UL 845-\ . Panelboards supplying non-linear loads shall have neutrals sized for 200 percent of rated current.

[AM#1]

**2.17.2 Motor Starters**

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**2.17.2.1 Reduced-Voltage Starters**

Reduced-voltage starters shall be provided for polyphase motors \~25 hp~\ or larger. Reduced-voltage starters shall be of the single-step autotransformer, reactor, or resistor type having an adjustable time interval between application of reduced and full voltages to the motors. Wye-delta reduced voltage starter or part winding increment starter having an adjustable time delay between application of voltage to first and second winding of motor may be used in lieu of the reduced voltage starters specified above for starting of motor-generator sets, centrifugally operated equipment or reciprocating compressors provided with automatic unloaders.

**2.17.3 Thermal-Overload Protection**

Each motor of \~1/8 hp~\ or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating.

**2.17.4 Low-Voltage Motor Overload Relays**

**2.17.4.1 General**

Thermal overload relays shall conform to \-NEMA ICS 2-\ and \-UL 508-\ . Overload protection shall be provided either integral with the motor or motor controller, and shall be rated in accordance with the requirements of \-NFPA 70-\ . Standard units shall be used for motor starting times up to 7 seconds. Slow units shall be used for motor starting times from 8 to 12 seconds. Quick trip units shall be used on hermetically sealed, submersible pumps, and similar motors.

**2.17.4.2 Construction**

Manual reset type thermal relay shall be bimetallic construction. Automatic reset type thermal relays shall be bimetallic construction. Magnetic current relays shall consist of a contact mechanism and a dash pot mounted on a common frame.

**2.17.4.3 Ratings**

Voltage ratings shall be not less than the applicable circuit voltage. Trip current ratings shall be established by selection of the replaceable overload device and shall not be adjustable. Where the controller is remotely-located or difficult to reach, an automatic reset, non-compensated overload relay shall be provided. Manual reset overload relays shall be provided otherwise, and at all locations where automatic starting is provided. Where the motor is located in a constant ambient temperature, and the thermal device is located in an ambient temperature that regularly varies by more than minus \~18

degrees F, an ambient temperature-compensated overload relay shall be provided.

#### **2.17.5 Automatic Control Devices**

##### **2.17.5.1 Direct Control**

Automatic control devices (such as thermostats, float or pressure switches) which control the starting and stopping of motors directly shall be designed for that purpose and have an adequate horsepower rating.

##### **2.17.5.2 Pilot-Relay Control**

Where the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit.

##### **2.17.5.3 Manual/Automatic Selection**

- a. Where combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch (marked MANUAL-OFF-AUTOMATIC) shall be provided for the manual control.
- b. Where combination manual and automatic control is specified and the automatic-control device actuates the pilot control circuit of a magnetic starter, the magnetic starter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC.
- c. Connections to the selector switch shall be such that; only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low-or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

#### **2.18 PANELBOARDS**

Dead-front construction, NEMA PB 1- and UL 67-.

#### **2.19 RECEPTACLES**

##### **2.19.1 Standard Grade**

UL 498-.

##### **2.19.2 Ground Fault Interrupters**

UL 943-, Class A or B.

### **2.19.3 NEMA Standard Receptacle Configurations**

\-NEMA WD 6-\.

a. Single and Duplex, 15-Ampere and 20-Ampere, 125 Volt  
15-ampere, non-locking: NEMA type 5-15R, locking: NEMA type L5-15R,  
20-ampere, non-locking: NEMA type 5-20R, locking: NEMA type L5-20R.

### **2.20 Service Module**

Service Module shall be a raised floor box suitable for flush mounting in raised floor panels. Box shall conform to UL 514A and shall be equipped with a hinged cover and trim flange. Boxes shall be equipped with number and type of outlets and connectors as indicated on the drawings. Port identification labels shall be as shown on the drawings. Modules shall be identified by station identification labels coordinated with patch panel labels in underfloor patch panels and patch panels located in equipment racks in the commo room to identify data cabling connections.

#### **2.20.1 Wiring Chamber**

The wiring chamber shall provide two separate compartments to accommodate power wiring on one side and communication wiring on the other side. The chamber shall also provide complete access to the communication wiring plate, which will allow for removal of the communication plate without the need to disconnect the wiring of any communication device.

[AM#1]

#### **2.20.2 Cover**

The hinged cover and trim flange shall be constructed of die cast zinc material with gray finish, and shall be removable and 180 degree reversible. Hinged cover and trim flange shall be suitable for carpet application. Carpet and installation shall be as specified for raised floor. The cover shall provide a removable guard for egress of power and communication workstation cables. The cable guard, when in use, shall extend above the surface of the cover for the purpose of added protection of the workstation cables.

#### **2.20.3 Installation**

Installation shall conform to manufacturer's instructions and shall be coordinated with raised floor manufacturer's recommendations for floor openings in raised floor panels. The box shall be secured to the raised floor by use of two locking toggles. The locking toggles shall be intergral with the box and adjusted by use of their locking screws.

### **2.21 Ceiling Fan**

Fan shall be 42-52 inch paddle type, variable speed, reversible, low profile. Fans shall be provided with 5 blades balanced and shaped to assure smooth operation. Motor shall be induction type, permanently lubricated, direct drive, capable of 225 RPM at high speed. Motor shall be three speed reversable, with air volume range between 1300 and 7000 CFM and speeds between 75 and 225 rpm. Motors shall be sufficiently isolated to provide quiet operation. Maximum power consumption shall be 80 watts and .7 amps. For finish and blade type, see SECTION \=09000=\ BUILDING COLOR AND FINISH

SCHEDULE. Each fan shall be provided with a wall control for on/off operation and to provide selection of speeds. Manufacturer's warranty shall be not less than 20 years.

**2.22 Service Entrance Equipment**

\-UL 869A-\.

**2.23 SPLICE, CONDUCTOR**

\-UL 486C-\.

**2.24 SNAP SWITCHES**

\-UL 20-\.

**2.25 TAPES**

**2.25.1 Plastic Tape**

\-UL 510-\.

**2.25.2 Rubber Tape**

\-UL 510-\.

**2.26 TRANSFORMERS**

Single- and three-phase transformers shall have two windings per phase. Full-capacity standard NEMA taps shall be provided in the primary windings of transformers unless otherwise indicated. Three-phase transformers shall be configured with delta-wye windings, except as indicated. "T" connections may be used for transformers rated 15 kVA or below.

[AM#1]

**2.26.1 Transformers, Dry-Type**

Transformers shall have 220 degrees C insulation system for transformers 15 kVA and greater, and shall have 180 degrees C insulation system for transformers rated 10 kVA and less, with temperature rise not exceeding 150 degrees C under full-rated load in maximum ambient temperature of 40 degrees C. Transformer of 150 degrees C temperature rise shall be capable of carrying continuously 100 percent of nameplate kVA without exceeding insulation rating.

a. 600 Volt or Less Primary:

\-NEMA ST 20-\, \-UL 506-\, general purpose, dry-type, self-cooled,. Provide transformers in NEMA enclosure. \_\_

b. 601 to 34,500 Volt Primary:

(1) Distribution: Ventilated, epoxy-resin cast coil,† 1 to 500 kVA, single phase, and 15 to 500 kVA, three-phase, low-voltage 120-600 volts:  
\-ANSI C57.12.50-\.

(2) Power: Ventilated, epoxy-resin cast coil, 501 kVA and larger, three-phase, low-voltage 208Y/120 to 4160 volts: \-ANSI C57.12.51-\.

(3) Power: Sealed, epoxy-resin cast coil, 501 kVA and larger, three-phase, low-voltage 208Y/120 to 4160 volts: \-ANSI C57.12.52-\.

C57.12.00-\.

### 2.26.2 Average Sound Level

The average sound level in decibels (dB) of transformers shall not exceed the following dB level at ~12 inches~ for the applicable kVA rating range listed unless otherwise indicated:

kVA Range	dB Sound Level
1-50	50
51-150	55
151-300	58
301-500	60
501-700	62
701-1000	64
1001-1500	65
1501 & above	70

[AM#1]

### 2.27 Harmonic Mitigating Transformers

\-NEMA ST 20-\ and \-UL 506-\ . Transformers shall be specially designed to address harmonic problems and shall remove the 3rd harmonic, triplens and other zero sequence harmonic currents within its secondary windings. Removal of these currents by trapping them in a delta primary winding is not acceptable. There shall be two outputs per phase, with a 15 degree phase-shift between them to achieve cancellation of 5th, 7th, 17th, 19th ... harmonic currents within the secondary windings. Transformers shall reduce current imbalance of fundamental (60Hz) current on primary side of the transformer. Harmonic cancellation shall be by electromagnetic means only. No capacitors or electronics shall be used. Quantitative performance data including before/after effect on voltage distortion at load panels that demonstrates the capability to achieve the specified harmonic treatment shall be submitted for approval. Transformers shall be three-phase, common core construction with copper windings and shall be convection air cooled. Anti-vibration pads shall be used between the core and the enclosure. Sound level shall be 45dB max at 5 feet. Neutral connection shall be rated at twice the ampacity of the total rated secondary phase current

#### 2.27.1 Voltage and kVA Requirements.

KVA and voltage ratings shall be as indicated on the drawings. Rating of each output as percent of input rating shall be 60%.

#### 2.27.2 Transformer Characteristics.

Positive & negative sequence impedance at 60Hz (for transformer configuration): 3.0%

Zero sequence reactance at 60Hz: 0.5% maximum

Crest Factor suitability: 4.5

Capability to deliver full nameplate kVA to loads of K-factor up to: 20

Insulation Class: H

Temperature rise: 150°C

Voltage Class: 1.2kV

BIL Rating: 10kV

Magnetic field at 1.5 feet: max. 0.1 Gauss

Full load Efficiency at 170°C: 97% minimum

Magnetizing Inrush Current: max. 10 times full load rating

## **2.28 WIRING DEVICES**

\-NEMA WD 1-\ for wiring devices, and \-NEMA WD 6-\ for dimensional requirements of wiring devices.

## **PART 3 - EXECUTION**

### **3.1 GROUNDING**

Grounding shall be in conformance with \-NFPA 70-\, the contract drawings, and the following specifications.

#### **3.1.1 Ground Rods**

The resistance to ground shall be measured using the fall-of-potential method described in \-IEEE Std 81-\ . The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, 2 additional rods not less than \~6 feet~\ on centers, or if sectional type rods are used, 2 additional sections may be coupled and driven with the first rod. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use \-UL 467-\ approved connectors.

#### **3.1.2 Grounding Conductors**

A green equipment grounding conductor, sized in accordance with \-NFPA 70-\ shall be provided, regardless of the type of conduit. Equipment grounding bars shall be provided in all panelboards. The equipment grounding conductor shall be carried back to the service entrance grounding connection or separately derived grounding connection. All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and

grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per \-NFPA 70-\.

When boxes for receptacles, switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

[AM#1]

### **3.2 WIRING METHODS**

Wiring shall conform to \-NFPA 70-\, the contract drawings, and the following specifications. Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid aluminum conduit, rigid zinc-coated steel conduit, rigid plastic conduit, electrical metallic tubing, electrical nonmetallic tubing, or intermediate metal conduit. Where cables and wires are installed in cable trays, they shall be of the type permitted by \-NFPA 70-\ for use in such applications. Wire fill in conduits shall be based on \-NFPA 70-\ for the type of conduit and wire insulations specified. Wire fill in conduits located in Class I or II hazardous areas shall be limited to 25 percent of the cross sectional area of the conduit.

[AM#1]

#### **3.2.1 Conduit and Tubing Systems**

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph WIRING METHODS. Minimum size of raceways shall be  $\sim 1/2$  inch. Only metal conduits will be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to \-NFPA 70-\.

Nonmetallic conduit and tubing may be used in damp, wet or corrosive locations when permitted by \-NFPA 70-\ and the conduit or tubing system is provided with appropriate boxes, covers, clamps, screws or other appropriate type of fittings. Electrical metallic tubing (EMT) may be installed only within buildings. EMT may be installed in concrete and grout in dry locations. EMT installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by \-NFPA 70-\.

Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Aluminum conduit may be used only where installed exposed in dry locations. Nonaluminum sleeves shall be used where aluminum conduit passes through concrete floors and firewalls. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped in accordance with Section =07270 =\FIRESTOPPING. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by \-NFPA 70-\.

Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept  $\sim 6$  inches away from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding. —

##### **3.2.1.1 Pull Wires**

A pull wire shall be inserted in each empty raceway in which wiring is to be installed if the raceway is more than ~50 feet~ in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than ~150 feet~ in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than ~200 pounds per square inch~ tensile strength. Not less than ~10 inches~ of slack shall be left at each end of the pull wire.

#### **3.2.1.2 Conduit Stub-Ups**

Where conduits are to be stubbed up through concrete floors, a short elbow shall be installed below grade to transition from the horizontal run of conduit to a vertical run. A conduit coupling fitting, threaded on the inside shall be installed, to allow terminating the conduit flush with the finished floor. Wiring shall be extended in rigid threaded conduit to equipment, except that where required, flexible conduit may be used ~6 inches~ above the floor. Empty or spare conduit stub-ups shall be plugged flush with the finished floor with a threaded, recessed plug.

#### **3.2.1.3 Below Slab-on-Grade or in the Ground**

Electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel or IMC. Rigid steel or IMC conduits installed below slab-on-grade or in the earth shall be field wrapped with ~0.010 inch~ thick pipe-wrapping plastic tape applied with a 50 percent overlay, or shall have a factory-applied polyvinyl chloride, plastic resin, or epoxy coating system.

#### **3.2.1.4 Installing in Slabs Including Slabs on Grade**

Conduit installed in slabs-on-grade shall be rigid steel or IMC. Conduits shall be installed as close to the middle of concrete slabs as practicable without disturbing the reinforcement. Outside diameter shall not exceed 1/3 of the slab thickness and conduits shall be spaced not closer than 3 diameters on centers except at cabinet locations where the slab thickness shall be increased as approved by the Contracting Officer. Where conduit is run parallel to reinforcing steel, the conduit shall be spaced a minimum of one conduit diameter away but not less than ~one inch~ from the reinforcing steel.

#### **3.2.1.5 Changes in Direction of Runs**

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Care shall be taken to prevent the lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment during the course of construction. Clogged raceways shall be cleared of obstructions or shall be replaced.

#### **3.2.1.6 Supports**

Except where otherwise permitted by ~NFPA 70~, conduits and tubing shall be securely and rigidly fastened in place at intervals of not more than ~10 feet~ and within ~3 feet~ of boxes, cabinets, and fittings, with approved

pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, beam clamps, or ceiling trapeze. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structure. Loads shall not be applied to joist bridging. Attachment shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Cutting the main reinforcing bars in reinforced concrete beams or joists shall be avoided when drilling holes for support anchors. Holes drilled for support anchors, but not used, shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Raceways shall not be supported using wire or nylon ties. Raceways shall be independently supported from the structure. Upper raceways shall not be used as a means of support for lower raceways. Supporting means will not be shared between electrical raceways and mechanical piping or ducts. Cables and raceways shall not be supported by ceiling grids. Except where permitted by \-NFPA 70-\, wiring shall not be supported by ceiling support systems. Conduits shall be fastened to sheet-metal boxes and cabinets with two locknuts where required by \-NFPA 70-\, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

#### **3.2.1.7 Exposed Raceways**

Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Raceways under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with \-NFPA 70-\ definitions.

#### **3.2.1.8 Exposed Risers**

Exposed risers in wire shafts of multistory buildings shall be supported by U-clamp hangers at each floor level, and at intervals not to exceed \~10 feet.~\

#### **3.2.1.9 Communications Raceways**

\&Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirements that no length of run shall exceed \~50 feet~\ for \~1/2 inch~\ and \~3/4 inch~\ sizes, and \~100 feet~\ for \~1 inch~\ or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of \~1 inch~\ size or larger shall not be less than ten times the nominal diameter.&\

#### **3.2.2 Cable Trays**

Cable trays shall be supported in accordance with the recommendations of the manufacturer but at no more than \~6 foot~\ intervals. Contact surfaces of

aluminum connections shall be coated with an antioxidant compound prior to assembly. Adjacent cable tray sections shall be bonded together by connector plates of an identical type as the cable tray sections. The Contractor shall submit the manufacturer's certification that the cable tray system meets all requirements of Article 318 of \-NFPA 70-\ . The cable tray shall be installed and grounded in accordance with the provisions of Article 318 of \-NFPA 70-\ . Data submitted by the Contractor shall demonstrate that the completed cable tray systems will comply with the specified requirements.

### **3.2.3 Cables and Conductors**

Installation shall conform to the requirements of \-NFPA 70-\ . Covered, bare or insulated conductors of circuits rated over 600 volts shall not occupy the same equipment wiring enclosure, cable, or raceway with conductors of circuits rated 600 volts or less.

#### **3.2.3.1 Sizing**

Unless otherwise noted, all sizes are based on copper conductors and the insulation types indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than \~100 feet~\ long and of 277 volts more than \~230 feet~\ long, from panel to load center, shall be no smaller than No. 10 AWG. Class 1 remote control and signal circuit conductors shall be not less than No. 14 AWG. Class 2 remote control and signal circuit conductors shall be not less than No. 16 AWG. Class 3 low-energy, remote-control and signal circuits shall be not less than No. 22 AWG.

#### **3.2.3.2 Use of Aluminum Conductors in Lieu of Copper**

Unless otherwise indicated, the Contractor may substitute aluminum conductors in lieu of copper conductors for copper sizes No. 4 AWG and larger. Should the Contractor choose to provide aluminum for conductors, the Contractor shall be responsible for increasing conductor size to have same ampacity as copper size indicated; increasing conduit and pull box sizes to accommodate larger size aluminum conductors in accordance with \-NFPA 70-\ ; ensuring that pulling tension rating of aluminum conductors is sufficient; providing panelboards that are UL listed for use with aluminum, and so labelled; relocating equipment, modifying equipment terminations, resizing equipment; and resolving problems that are a direct result of providing aluminum conductors in lieu of copper.

#### **3.2.3.3 Cable Systems**

Cable systems shall be installed where indicated. Cables shall be installed concealed behind ceiling or wall finish where practicable. Cables shall be threaded through holes bored on the approximate centerline of wood members; notching of surfaces will not be permitted. Sleeves shall be provided through bond beams of masonry-block walls for threading cables through hollow spaces. Exposed cables shall be installed parallel or at right angles to walls or structural members. In rooms or areas not provided with ceiling or wall finish, cables and outlets shall be installed so that a room finish may be applied in the future without disturbing the cables or resetting the boxes. Exposed nonmetallic-sheathed cables less than \~4 feet~\ above floors shall be protected from mechanical injury by installation in conduit or tubing.

#### **3.2.3.4 Cable Splicing**

Splices shall be made in an accessible location. Crimping tools and dies shall be approved by the connector manufacturer for use with the type of connector and conductor.

a. Copper Conductors, 600 Volt and Under: Splices in conductors No. 10 AWG and smaller diameter shall be made with an insulated, pressure-type connector. Splices in conductors No. 8 AWG and larger diameter shall be made with a solderless connector and insulated with tape or heat-shrink type insulating material equivalent to the conductor insulation.

b. Aluminum Conductors, 600 Volt and Under: Splices of aluminum conductors shall be made with a UL listed, solderless, compression-type, aluminum bodied connector, stamped for AL or AL/CU. Aluminum contact surfaces of conductors shall be cleaned with a wire brush and covered with anti-oxidant joint compound prior to making of connections. Any excess joint compound shall be wiped away after installing the connector. Insulate the connection with tape or heat-shrink type insulating material equivalent to the conductor insulation.

c. Greater Than 600 Volt: Cable splices shall be made in accordance with the cable manufacturer's recommendations and Section 16375-ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

#### **3.2.3.5 Conductor Identification and Tagging**

Power, control, and signal circuit conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

a. Color coding shall be provided for service, feeder, branch, and ground conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutral shall be white with colored (not green) stripe. The color coding for three-phase and single-phase low voltage systems shall be as follows:

120/208-volt, 3-phase: Black(A), red(B), and blue(C).  
277/480-volt, 3-phase: Brown(A), orange(B), and yellow(C).  
120/240-volt, 1-phase: Black and red.

b. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 3 inches of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer.

c. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

### **3.3 BOXES AND SUPPORTS**

Boxes shall be provided in the wiring or raceway systems where required by \-NFPA 70-\ for pulling of wires, making connections, and mounting of devices or fixtures. Pull boxes shall be furnished with screw-fastened covers. Indicated elevations are approximate, except where minimum mounting heights for hazardous areas are required by \-NFPA 70-\ . Unless otherwise indicated, boxes for wall switches shall be mounted \~48 inches~\ above finished floors. Switch and outlet boxes located on opposite sides of fire rated walls shall be separated by a minimum horizontal distance of \~24 inches.~\ The total combined area of all box openings in fire rated walls shall not exceed \~100 square inches~\ per \~100 square feet.~\ Maximum box areas for individual boxes in fire rated walls vary with the manufacturer and must not exceed the maximum specified for that box in \-UL-03-\ . Only boxes listed in \-UL-03-\ shall be used in fire rated walls.

#### **3.3.1 Box Applications**

Each box shall have not less than the volume required by \-NFPA 70-\ for number of conductors enclosed in box. Boxes for metallic raceways, \~4 by 4 inch~\ nominal size and smaller, shall be of the cast-metal hub type when located in normally wet locations, when flush and surface mounted on outside of exterior surfaces, or when located in hazardous areas. Cast-metal boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. Boxes for mounting lighting fixtures shall be not less than \~4 inches~\ square, or octagonal, except smaller boxes may be installed as required by fixture configuration, as approved. Cast-metal boxes with \~3/32 inch~\ wall thickness are acceptable. Large size boxes shall be NEMA 1. Boxes in other locations shall be sheet steel except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit and tubing or nonmetallic sheathed cable system, when permitted by \-NFPA 70-\ . Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

#### **3.3.2 Brackets and Fasteners**

Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screw or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. Penetration of more than \~1-1/2 inches~\ into reinforced-concrete beams or more than \~3/4 inch~\ into reinforced-concrete joists shall avoid cutting any main reinforcing steel. The use of brackets which depend on gypsum wallboard or plasterboard for primary support will not be permitted. In partitions of light steel construction, bar hangers with \~1 inch~\ long studs, mounted between metal

wall studs or metal box mounting brackets shall be used to secure boxes to the building structure. When metal box mounting brackets are used, additional box support shall be provided on the side of the box opposite the brackets. This additional box support shall consist of a minimum  $\sim 12$  inch $\sim$  long section of wall stud, bracketed to the opposite side of the box and secured by two screws through the wallboard on each side of the stud. Metal screws may be used in lieu of the metal box mounting brackets.

### **3.3.3 Mounting in Walls, Ceilings, or Recessed Locations**

In walls or ceilings of concrete, tile, or other non-combustible material, boxes shall be installed so that the edge of the box is not recessed more than  $\sim 1/4$  inch $\sim$  from the finished surface. Boxes mounted in combustible walls or ceiling material shall be mounted flush with the finished surface. The use of gypsum or plasterboard as a means of supporting boxes will not be permitted. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be mounted flush with the top of a block to minimize cutting of the blocks, and boxes shall be located horizontally to avoid cutting webs of block. Separate boxes shall be provided for flush or recessed fixtures when required by the fixture terminal operating temperature, and fixtures shall be readily removable for access to the boxes unless ceiling access panels are provided.

### **3.3.4 Installation in Overhead Spaces**

In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than  $\sim 24$  inches $\sim$  from the box.

## **3.4 DEVICE PLATES**

One-piece type device plates shall be provided for all outlets and fittings. Plates on unfinished walls and on fittings shall be of zinc-coated sheet steel, cast-metal, or impact resistant plastic having rounded or beveled edges. Plates on finished walls shall be of steel with baked enamel finish or impact-resistant plastic and shall be ivory. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of  $\sim 1/16$  inch $\sim$ . The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

## **3.5 RECEPTACLES**

### **3.5.1 Single and Duplex, 15 or 20-ampere, 125 volt**

Single and duplex receptacles shall be rated 15 amperes, 125 volts, two-pole, three-wire, grounding type with polarized parallel slots. Bodies shall be of

ivory to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided as required by \-NFPA 70-\ and as indicated on the drawings.

### **3.5.2 Clock Outlet**

Clock outlet, for use in other than a wired clock system, shall consist of an outlet box, a plaster cover where required, and a single receptacle with clock-outlet plate. The receptacle shall be recessed sufficiently within the box to allow the complete insertion of a standard cap, flush with the plate. A suitable clip or support for hanging the clock shall be secured to the top of the plate. Material and finish of the plate shall be as specified in paragraph DEVICE PLATES.

### **3.5.3 Floor Outlets**

Floor outlets shall be as shown on the drawings.

### **3.5.4 Weatherproof Applications**

Weatherproof receptacles shall be suitable for the environment, damp or wet as applicable, and the housings shall be labeled to identify the allowable use. Receptacles shall be marked in accordance with \-UL 514A-\ for the type of use indicated; "Damp locations", "Wet Locations", "Wet Location Only When Cover Closed". Assemblies shall be installed in accordance with the manufacturer's recommendations.

#### **3.5.4.1 Damp Locations**

Receptacles in damp locations shall be mounted in an outlet box with a gasketed, weatherproof, cast-metal cover plate (device plate, box cover) and a gasketed cap (hood, receptacle cover) over each receptacle opening. The cap shall be either a screw-on type permanently attached to the cover plate by a short length of bead chain or shall be a flap type attached to the cover with a spring loaded hinge.

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#### **3.5.4.2 Wet Locations**

Receptacles in wet locations shall be installed in an assembly rated for such use whether the plug is inserted or withdrawn, unless otherwise indicated. In a duplex installation, the receptacle cover shall be configured to shield the connections whether one or both receptacles are in use. \_\_

### **3.5.5 Receptacles, 15-Ampere, 250-Volt**

Receptacles, 15-ampere, 250-volt, shall be duplex two-pole, three-wire, grounding type with bodies of ivory phenolic compound supported by mounting yoke having plaster ears. The third grounding pole shall be connected to the metal yoke. Each receptacle shall be provided with a mating cord-grip plug.

### **3.6 WALL SWITCHES**

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall be ivory. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 20-ampere for use on alternating current only. Pilot lights indicated shall consist of yoke-mounted candelabra-base sockets rated at 75 watts, 125 volts, and fitted with glass or plastic jewels. A clear 6-watt lamp shall be furnished and installed in each pilot switch. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red. Dimming switches shall be solid-state flush mounted, sized for the loads.

### **3.7 PANELBOARDS AND LOADCENTERS**

Circuit breakers and switches used as a motor disconnecting means shall be capable of being locked in the open position. Door locks shall be keyed alike. Nameplates shall be as approved. Directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering. Busses shall be copper .

#### **3.7.1 Loadcenters**

Loadcenters shall be circuit breaker equipped.

#### **3.7.2 Panelboards**

Panelboards shall be circuit breaker or fusible switch equipped as indicated on the drawings.

### **3.8 FUSES**

Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilize fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination. Time-delay and non-time-delay options shall be as specified.

#### **3.8.1 Cartridge Fuses; Noncurrent-Limiting Type**

Cartridge fuses of the noncurrent-limiting type shall be Class H, nonrenewable, dual element, time lag type and shall have interrupting capacity of 10,000 amperes. At 500 percent current, cartridge fuses shall not blow in less than 10 seconds.

#### **3.8.2 Cartridge Fuses; Current-Limiting Type**

Cartridge fuses, current-limiting type, Class G J K L RK1 RK5 RK9 T CC shall have tested interrupting capacity not less than 100,000 amperes. Fuse holders shall be the type that will reject all Class H fuses.

[AM#1]

**3.8.3 Continuous Current Ratings (Greater than 600 Amperes)**

Service entrance and feeder circuit fuses (greater than 600 amperes) shall be Class L, current-limiting, nontime-delay with 200,000 amperes interrupting capacity.

**3.8.4 Motor and Transformer Circuit Fuses**

Motor, motor controller, transformer, and inductive circuit fuses shall be Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

**3.9 MOTORS**

Each motor shall conform to the  $\sim$ hp $\sim$  and voltage ratings indicated, and shall have a service factor and other characteristics that are essential to the proper application and performance of the motors under conditions shown or specified. Three-phase motors for use on 3-phase 208-volt systems shall have a nameplate rating of 200 volts. Unless otherwise specified, all motors shall have open frames, and continuous-duty classification based on a 40 degree C ambient temperature reference. Polyphase motors shall be squirrel-cage type, having normal-starting-torque and low-starting-current characteristics, unless other characteristics are specified in other sections of these specifications or shown on contract drawings. The Contractor shall be responsible for selecting the actual  $\sim$ horsepower $\sim$  ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

**3.10 MOTOR CONTROL**

Each motor or group of motors requiring a single control shall be provided under other sections of these specifications with a suitable controller and devices that will perform the functions as specified for the respective motors. Each motor of  $\sim$ 1/8 hp $\sim$  or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for that purpose and have an adequate  $\sim$ horsepower $\sim$  rating. When the automatic-control device does not have such a rating, a magnetic starter shall be used, with the

automatic-control device actuating the pilot-control circuit. When combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch shall be provided for the manual control; when the automatic-control device actuates the pilot control circuit of a magnetic starter, the latter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control devices, such as low- or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

### **3.10.1 Reduced-Voltage Controllers**

Reduced-voltage controllers shall be provided for polyphase motors \~25 hp~\ or larger. Reduced-voltage starters shall be of the single-step autotransformer, reactor, or resistor type having an adjustable time interval between application of reduced and full voltages to the motors. Wye-delta reduced voltage starters or part winding increment starters having an adjustable time delay between application of voltage to first and second winding of motor may be used in lieu of the reduced voltage starters specified above for starting of motor-generator sets, centrifugally operated equipment or reciprocating compressors provided with automatic unloaders.

### **3.10.2 Contacts**

Unless otherwise indicated, contacts in miscellaneous control devices such as float switches, pressure switches, and auxiliary relays shall have current and voltage ratings in accordance with \-NEMA ICS 2-\ for rating designation B300.

### **3.10.3 Safety Controls**

Safety controls for boilers shall be connected to a 2-wire, 120 volt grounded circuit supplied from the associated boiler-equipment circuit. Where the boiler circuit is more than 120 volts to ground, safety controls shall be energized through a two-winding transformer having its 120 volt secondary winding grounded. Overcurrent protection shall be provided in the ungrounded secondary conductor and shall be sized for the load encountered.

### **3.11 MOTOR-DISCONNECT MEANS**

Each motor shall be provided with a disconnecting means when required by \-NFPA 70-\ even though not indicated. For single-phase motors, a single or double pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

[AM#1]

### **3.12 TRANSFORMER INSTALLATION**

Three-phase transformers shall be connected only in a delta-wye configuration as indicated [except isolation transformers having a one-to-one turns ratio]. "T" connections may be used for transformers rated at 15 kVA or below. Dry-type transformers shown located within \~5 feet~\ of the exterior wall shall be provided in a weatherproof enclosure. Transformers to be located within the building may be provided in the manufacturer's standard, ventilated indoor enclosure designed for use in 40 degrees C ambient temperature, unless otherwise indicated.

### **3.13 LAMPS AND LIGHTING FIXTURES**

Ballasted fixtures shall have ballasts which are compatible with the specific type and rating of lamps indicated and shall comply with the applicable provisions of the publications referenced.

#### **3.13.1 Lamps**

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed in the fixtures just prior to the completion of the project.

##### **3.13.1.1 Incandescent**

Incandescent lamps shall be for 125-volt operation unless otherwise indicated.

##### **3.13.1.2 Fluorescent**

Fluorescent lamps for electronic ballasts shall be as indicated.

##### **3.13.1.3 High-Intensity-Discharge**

High-intensity-discharge lamps shall be the high-pressure sodium type unless otherwise indicated, shown, or approved.

#### **3.13.2 Fixtures**

Fixtures shall be as shown and shall conform to the following specifications and shall be as detailed on Standard Drawing No. 40-06-04, Sheet Nos. 3,9,17,20,25,31,36,39,47,50,56 and 66, which accompany and form a part of this specification for the types indicated. Illustrations shown on these sheets are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent energy efficiency, light distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved. In suspended acoustical ceilings with fluorescent fixtures, the fluorescent emergency light fixtures shall be furnished with self-contained battery packs.

##### **3.13.2.1 Accessories**

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation. Open type fluorescent fixtures with exposed lamps shall have a wire-basket type guard.

### **3.13.2.2 Suspended Fixtures**

Suspended fixtures shall be provided with swivel hangers in order to ensure a plumb installation. Pendants, rods, or chains ~4 feet~\or longer excluding fixture, shall be braced to limit swinging. Bracing shall be 3 directional, 120 degrees apart. Single unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple unit or continuous-row fluorescent units shall have a tubing or stem for wiring at one point, and a tubing or rod suspension provided for each length of chassis including one at each end. Maximum distance between adjacent tubing or stems shall be ~10 feet.~\ Rods shall be of not less than ~3/16 inch~\ diameter. Flexible raceway shall be installed to each fixture from an overhead junction box. Fixture to fixture wiring installation is allowed only when fixtures are installed end to end in a continuous run.

### **3.13.2.3 Ceiling Fixtures**

Ceiling fixtures shall be coordinated with and suitable for installation in, on, or from the suspended ceiling provided under other sections of these specifications. Installation and support of fixtures shall be in accordance with the \-NFPA 70-\ and manufacturer's recommendations. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive type of suspended ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling panels, in conformance with \-UL-03-\ . Surface-mounted fixtures shall be suitable for fastening to the structural support for ceiling panels.

### **3.13.2.4 Sockets**

Sockets of industrial, strip, and other open type fluorescent fixtures shall be of the type requiring a forced movement along the longitudinal axis of the lamp for insertion and removal of the lamp.

### **3.13.3 Emergency Light Sets**

Emergency light sets shall conform to \-UL 924-\ with the number of heads as indicated. Sets shall be permanently connected to the wiring system by conductors installed in short lengths of flexible conduit.

### **3.14 BATTERY CHARGERS**

Battery chargers shall be installed in conformance with \-NFPA 70-\ .

### **3.15 EQUIPMENT CONNECTIONS**

All wiring not furnished and installed under other sections of the specifications for the connection of electrical equipment as indicated on the drawings shall be furnished and installed under this section of the specifications. Connections shall comply with the applicable requirements of paragraph WIRING METHODS. Flexible conduits ~6 feet~\ or less in length shall be provided to all electrical equipment subject to periodic removal, vibration, or movement and for all motors. All motors shall be provided with separate grounding conductors. Liquid-tight conduits shall be used in damp or wet locations.

**3.15.1 Motors and Motor Control**

Motors and motor controls shall be installed in accordance with \-NFPA 70-\, the manufacturer's recommendations, and as indicated. Wiring shall be extended to motors and motor controls and terminated.

**3.15.2 Installation of Government-Furnished Equipment**

Wiring shall be extended to the equipment and terminated.

**3.16 CIRCUIT PROTECTIVE DEVICES**

The Contractor shall calibrate, adjust, set and test each new adjustable circuit protective device to ensure that they will function properly prior to the initial energization of the new power system under actual operating conditions.

**3.17 PAINTING AND FINISHING**

Field-applied paint on exposed surfaces shall be provided under Section \=09900=\ PAINTING, GENERAL.

**3.18 REPAIR OF EXISTING WORK**

The work shall be carefully laid out in advance, and where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceiling, or other surfaces is necessary for the proper installation, support, or anchorage of the conduit, raceways, or other electrical work, this work shall be carefully done, and any damage to building, piping, or equipment shall be repaired by skilled mechanics of the trades involved at no additional cost to the Government.

**3.19 \+FIELD TESTING+\**

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 30 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspection recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports will be signed and dated by the Contractor.

**3.19.1 Safety**

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

**3.19.2 \+Ground-Resistance Tests+\**

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in \-IEEE Std 81-\. Soil resistivity in the area of the grid shall be measured concurrently with the grid measurements.

Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- a. Single rod electrode - 25 ohms.
- b. Grid electrode - 25 ohms.

### **3.19.3 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 8 hours before the site is ready for inspection.

### **3.19.4 \+TV Testing+\**

After installation of the coaxial cable and before splicing in the system components, each cable section shall be tested using a time domain reflectometer (TDR) to determine shorts, open, kinks, and other impedance discontinuities and their locations. Cable sections showing adverse impedance discontinuities shall be replaced at the Contractor's expense. There shall be no cable splices between system components unless approved by the Contracting Officer.

### **3.19.5 \+Cable Tests+\**

The Contractor shall be responsible for identifying all equipment and devices that could be damaged by application of the test voltage and ensuring that they have been properly disconnected prior to performing insulation resistance testing. An insulation resistance test shall be performed on all low and medium voltage cables after the cables are installed in their final configuration and prior to energization. The test voltage shall be 500 volts DC applied for one minute between each conductor and ground and between all possible combinations of conductors. The minimum value of resistance shall be:

$\sim R \text{ in megohms} = (\text{rated voltage in kV} + 1) \times 1000 / (\text{length of cable in feet}) \sim$

Each cable failing this test shall be repaired or replaced. The repaired cable system shall then be retested until failures have been eliminated.

#### **3.19.5.1 Low Voltage Cable Tests**

- a. Continuity test.
- b. Insulation resistance test.

### **3.19.6 \+Metal Enclosed Bus Duct Tests+\**

- a. Insulation Resistance phase-to-phase, all combinations.
- b. Insulation resistance phase-to-ground, each phase.

- c. AC or DC high-potential test.
- d. Phase rotation test.

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**3.19.7 \+Motor Tests+\**

- a. Phase rotation test to ensure proper directions.
- b. Operation and sequence of reduced voltage starters.
- c. High potential test on each winding to ground.
- d. Insulation resistance of each winding to ground.
- e. Vibration test.
- f. Dielectric absorption test on motor and starter.

**3.19.8 \+Circuit Breaker Tests+\**

The following field tests shall be performed on circuit breakers.

**3.19.8.1 Circuit Breaker Tests, Medium Voltage**

- a. Insulation resistance test phase-to-phase, all combinations.
- b. Insulation resistance tests phase-to-ground, each phase.
- c. Closed breaker contact resistance test.
- d. Power factor test.
- e. High-potential test.
- f. Manual and electrical operation of the breaker.

**3.19.8.2 Circuit Breakers, Low Voltage**

- a. Insulation resistance test phase-to-phase, all combinations.
- b. Insulation resistance test phase-to-ground, each phase.
- c. Closed breaker contact resistance test.
- d. Manual and electrical operation of the breaker.

**3.19.8.3 Circuit Breakers, Molded Case**

- a. Insulation resistance test phase-to-phase, all combinations.
- b. Insulation resistance test phase-to-ground, each phase.
- c. Closed breaker contact resistance test.

d. Manual operation of the breaker.

**3.19.9 Protective Relays**

Protective relays shall be visually and mechanically inspected, adjusted, tested, and calibrated in accordance with the manufacturer's published instructions. These tests shall include pick-up, timing, contact action, restraint, and other aspects necessary to insure proper calibration and operation. Relay settings shall be implemented in accordance with the coordination study. Relay contacts shall be manually or electrically operated to verify that the proper breakers and alarms initiate. Relaying current transformers shall be field tested in accordance with IEEE ANSI/IEEE C57.13-1989.

**3.20 OPERATING TESTS**

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph FIELD TEST REPORTS.

**3.21 FIELD SERVICE**

**3.21.1 Onsite Training**

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, 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 shall be submitted.

**3.21.2 Installation Engineer**

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

**3.22 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.

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