AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF PAGES
	1	6

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. *(If applicable)*
0001	13 AUG 98		

6. ISSUED BY CODE

Department of the Army
Corps of Engineers
Fort Worth District

7. ADMINISTERED BY *(If other than Item 6)* CODE

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*

CODE FACILITY CODE

(√) X

9A. AMENDMENT OF SOLICITATION NO.
DACA63-98-B-0040

9B. DATED *(SEE ITEM 11)*
27 JULY 1998

10A. MODIFICATION OF CONTRACTS/ORDER NO.

10B. DATED *(SEE ITEM 13)*

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers [ ] is extended, [X] 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 "26 AUGUST 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 *(Signature of person authorized to sign)*	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY *(Signature of Contracting Officer)*	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. 0001 TO SOLICITATION NO. DACA63-98-B-0040", shall be substituted therefor.

b. Wage Rates.

Void pages 00710-1 through 00710-8, and substitute therfor the attached pages 00710-1 through 00710-8, each page bearing the notation "ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040".

c. Special Contract Requirements and Specifications

(1) Section 01410, Attachment A.- At the end of the section, replace Attachment A BASIC STORM WATER POLLUTION PREVENTION PLAN FOR GENERAL INSTRUCTION BUILDING (PHASE I), FORT HOOD, TEXAS with the accompanying new Attachment A, same title and bearing the notation "ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040".

(2) 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. 0001 TO SOLICITATION NO. DACA63-98-B-0040" shall be substituted therefor:

Section No.	Title
00800	SPECIAL CONTRACT REQUIREMENTS
02050	DEMOLITION
02051	REMOVAL, RECYCLING AND DISPOSAL OF REGULATED MATERIALS PRIOR TO BUILDING DEMOLITION
02080	WORKER PROTECTION DURING DEMOLITION OF STRUCTURES THAT CONTAIN ASBESTOS CONTAINING MATERIAL (ACM)
02091	LEAD-CONTAINING PAINT (LCP) WORKER PROTECTION PLAN
02221	EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS
02222	EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS
02225	EARTHWORK FOR ROADWAYS, RAILROADS, AND AIRFIELDS
02234	SUBBASE COURSE
02240	LIME-STABILIZED BASE COURSE, SUBBASE, OR SUBGRADE
02241	AGGREGATE BASE COURSE
02511	CONCRETE SIDEWALKS AND CURBS AND GUTTERS
02516	CONCRETE PAVEMENT
02526	WHEEL STOPS
02551	BITUMINOUS PAVING FOR ROADS, STREETS, AND PARKING AREAS
02556	ASPHALTIC BITUMINOUS HEAVY-DUTY PAVEMENT (CENTRAL-PLANT HOT MIX)
02660	WATER DISTRIBUTION SYSTEMS
02685	GAS DISTRIBUTION SYSTEMS
02720	STORM-DRAINAGE SYSTEMS
02812	IRRIGATION (SPRINKLER) SYSTEM
03300	CAST-IN-PLACE STRUCTURAL CONCRETE
04200	MASONRY
04255	NONBEARING MASONRY VENEER/STEEL STUD WALLS
04735	CAST STONE
05500	MISCELLANEOUS METAL
06100	ROUGH CARPENTRY

06200	FINISH CARPENTRY
07160	BITUMINOUS DAMPPROOFING
07220	ROOF INSULATION
07240	EXTERIOR INSULATION AND FINISH SYSTEM
07416	STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM
07532	ELASTOMERIC SHEET ROOFING SYSTEM (CSPE)
07600	SHEET METALWORK, GENERAL
07810	UNIT SKYLIGHTS
07900	JOINT SEALING
08110	STEEL DOORS AND FRAMES
08120	ALUMINUM DOORS, FRAMES AND WINDOW WALL
08210	WOOD DOORS
08330	OVERHEAD ROLLING DOORS
08353	OPERABLE PARTITIONS
08520	ALUMINUM WINDOWS
08700	BUILDERS' HARDWARE
08810	GLASS AND GLAZING
09000	BUILDING COLOR AND FINISH SCHEDULE
09250	GYPSUM WALLBOARD
09310	CERAMIC TILE
09510	ACOUSTICAL CEILINGS
09650	RESILIENT FLOORING
09900	PAINTING, GENERAL
10100	MISCELLANEOUS ITEMS
10160	TOILET PARTITIONS AND VANITY UNITS
10260	CORNER PROTECTION
10270	RAISED FLOOR SYSTEM
10800	TOILET ACCESSORIES
12520	WINDOW TREATMENTS
13814	BUILDING PREPARATION FOR ENERGY MONITORING AND CONTROL SYSTEMS (EMCS)
15895	AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM
15950	HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS
16375	ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND
16415	ELECTRICAL WORK, INTERIOR (Lighting Fixtures remain unchanged)
16528	EXTERIOR LIGHTING
16670	LIGHTNING PROTECTION SYSTEM
16710	PREMISES DISTRIBUTION SYSTEM
16711	TELEPHONE SYSTEM, OUTSIDE PLANT
16721	FIRE DETECTION AND ALARM SYSTEM
16770	RADIO AND PUBLIC ADDRESS SYSTEMS

(2) New Sections. - The following listed accompanying new sections, each bearing the notation "ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040" shall be added to the specifications and add each to the Table of Contents:

Section No.	Title
02110	CLEARING AND GRUBBING
02575	PAVEMENT REMOVAL
02592A	FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS
02831A	FENCE, CHAIN-LINK
07112	BITUMINOUS WATERPROOFING

d. Drawings.

(1) New Drawings.- The new drawings listed below which accompany this amendment, each bearing the notation "AM #0001" shall be added to and become a part of the Contract Drawings and shall be added to the INDEX TO DRAWINGS.

Sequence No.	Sheet No.	Title
New Drawings		
Seq 208	E42	BID OPTION 2 - DEMOLITION PLAN

(2) Reisssued Drawings.- The drawings listed below shall be voided and the attached new drawings of the same number, each bearing the notation "AM #0001", shall be substituted therefor:

Sequence No.		
Seq 0	G-1	INDEX SHEET 1
Seq 1	C-1	PROJECT LOCATION MAP
Seq 2	C-2	SITE DEVELOPMENT PLAN & BID OPTIONS
Seq 3	C-3	DELETED FROM CONTRACT
Seq 4	C-4	DEMOLITION PLAN 1
Seq 5	C-5	DEMOLITION PLAN 2
Seq 6	C-6	DEMOLITION PLAN 3
Seq 7	C-7	DEMOLITION PLAN 4
Seq 8	C-8	DEMOLITION PLAN 5
Seq 9	C-9	UTILITY DEMOLITION PLAN 1
Seq 10	C-10	UTILITY DEMOLITION PLAN 2
Seq 11	C-13	UTILITY DEMOLITION PLAN 5
Seq 12	C-14	PAVEMENT PLAN 1
Seq 13	C-15	PLAN-PROFILES 1 HEADQUARTERS AVE
Seq 14	C-16	PLAN-PROFILES 2 N-S ACCESS DR NO. 1
Seq 15	C-17	PLAN-PROFILES 3 N-S ACCESS DR NO. 2
Seq 16	C-18	PLAN-PROFILES 4 N-S ACCESS DR NO. 3
Seq 17	C-19	PLAN- PROFILES 5 N-S ACCESS DR NO. 4
Seq 18	C-20	PLAN-PROFILES 5 SUPPORT AVE.
Seq 19	C-21	LAYOUT PLAN 1
Seq 20	C-22	LAYOUT PLAN 2
Seq 21	C-23	GRADING PLAN 1
Seq 22	C-24	GRADING PLAN 2
Seq 23	C-25	GRADING PLAN 3
Seq 24	C-26	GRADING PLAN 4
Seq 25	C-27	GRADING PLAN 5
Seq 26	C-29	UTILITY PLAN 1
Seq 27	C-30	UTILITY PLAN 2
Seq 28	C-31	STORM DRAINAGE PLAN 1
Seq 29	C-32	STORM DRAINAGE PLAN 2
Seq 30	C-33	STORM DRAIN PROFILES 1
Seq 31	C-34	STORM DRAIN PROFILES 2
Seq 32	C-35	STORM DRAIN PROFILES 3
Seq 33	C-36	STORM DRAIN PROFILES 4
Seq 34	C-37	SANITARY SEWER PLAN
Seq 35	C-38	SANITARY SEWER PROFILES 1

Seq 36	C-39	SANITARY SEWER PROFILES 2
Seq 37	C-40	PAVING DETAILS 1
Seq 38	C-41	PAVING DETAILS 2
Seq 39	C-42	PAVING DETAILS 3
Seq 40	C-43	STORM DRAIN DETAILS 1
Seq 41	C-44	STORM DRAIN DETAILS 2
Seq 42	C-45	UTILITY DETAILS
Seq 43	C-46	MISCELLANOUS DETAILS 1
Seq 54	H-7	STORM WATER CONTROL PLAN - I
Seq 55	H-8	STORM WATER CONTROL PLAN - II
Seq 56	H-9	STORM WATER CONTROL PLAN - III
Seq 57	H-10	STORM WATER CONTROL PLAN - IV
Seq 58	H-11	STORM WATER CONTROL PLAN - V
Seq 59	H-12	STORM WATER CONTROL PLAN - VI
Seq 61	H-14	STORM WATER CONTROL PLAN - VIII
Seq 67	L-1	LANDSCAPE PLAN: OPTIONS 3A-C
Seq 69	A- 1	FIRST FLOOR LIFE SAFETY PLAN
Seq 70	A-2	SECOND FLOOR LIFE SAFETY PLAN
Seq 73	A-5	AREA "A" 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 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 84	A-16	OVERALL ROOF PLAN
Seq 85	A-17	OVERALL BUILDING ELEVATIONS
Seq 86	A-18	BUILDING ELEVATIONS
Seq 87	A-19	BUILDING ELEVATIONS
Seq 88	A-20	BUILDING ELEVATIONS
Seq 96	A-28	ENLARGED FLOOR PLANS AND ELEVATIONS
Seq 98	A-30	DOOR-WINDOW & LOUVER SCHEDULES
Seq 101	A-33	ROOF DETAILS
Seq 102	A-34	ROOF DETAILS
Seq 114	A-46	MISC. DETAILS
Seq 139	M3	MECHANICAL SCHEDULES
Seq 140	M4	CENTRAL PLANT HVAC PLAN - AREA A
Seq 141	M5	HVAC PLAN - AREA B, C, & D - FIRST FLOOR
Seq 142	M6	HVAC PLAN - AREA E & F - FIRST FLOOR
Seq 143	M7	HVAC PLAN - AREA B, C, & D - SECOND FLOOR
Seq 144	M8	HVAC PLAN - AREA E & F - SECOND FLOOR
Seq 145	M9	HVAC FAN ROOM PLANS
Seq 147	M11	HVAC DETAILS
Seq 148	M12	HYDRONIC FLOW SCHEMATICS
Seq 151	M15	CHILLED WATER SYSTEM CONTROLS I
Seq 152	M16	CHILLED WATER SYSTEM CONTROLS II
Seq 153	M17	HEATING WATER SYSTEM CONTROLS I
Seq 155	M19	AIR HANDLING UNIT AHU-B,C & D CONTROLS I
Seq 156	M20	AIR HANDLING UNIT AHU-B,C & D CONTROLS II
Seq 164	FP1	FIRST FLOOR FIRE PROTECTION PLAN
Seq 165	FP2	SECOND FLOOR FIRE PROTECTION PLAN
Seq 166	FP3	FIRE PROTECTION DETAILS
Seq 167	E1	EXTERIOR LEGEND & DETAILS
Seq 168	E2	EXTERIOR DEMOLITION PLAN AREA 1
Seq 170	E4	NEW EXTERIOR PLAN AREA 1
Seq 174	E8	BUILDING AREA CONDUIT PLAN
Seq 176	E10	BUILDING AREA FIRE ALARM & PA SYSTEM RISER
Seq 179	E13	PULLBOX AND DUCT DETAILS
Seq 181	E15	MATERIAL LIST & POLE DETAILS
Seq 184	E18	INTERIOR LEGEND AND LIGHTING FIXTURE SCHEDULE

Seq 193	E27	LIGHTING, POWER & COMMUNICATION PLAN AREA A
Seq 194	E28	LIGHTNING PROTECTION PLAN
Seq 195	E29	COMPOSITE FIRE ALARM RISER DIAGRAM
Seq 199	E33	INTERIOR DETAIL PLAN

(3) Deleted Drawings.- The drawings listed below have been deleted from the solicitation:

Seq 3	C-3	OFFSITE DEMOLITION
Seq 48	H-1	REGULATED MATERIAL SAMPLE LOCATIONS & QUANTITIES - I
Seq 49	H-2	REGULATED MATERIAL SAMPLE LOCATIONS - II
Seq 50	H-3	REGULATED MATERIAL SAMPLE LOCATIONS - III
Seq 51	H-4	REGULATED MATERIAL SAMPLE LOCATIONS - IV
Seq 52	H-5	REGULATED MATERIAL SAMPLE LOCATIONS - V
Seq 53	H-6	REGULATED MATERIAL SAMPLE LOCATIONS - VI
Seq 60	H-13	STORM WATER CONTROL PLAN - VII

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

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	**General Instruction Building - Phase I**, complete, including utilities to the five-foot line; excluding all other work separately listed				
		Job	Sum	***	$_____
0002	**Central Energy Plant**, complete, including utilities to the five-foot line				
		Job	Sum	***	$_____
0003	**Drilled Piers**				
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	**Abatement and Removal of Hazardous Materials**				
		Job	Sum	***	$_____
0005	**Site Work** 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 $_____

0006 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 $_____

0007 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)

0008 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 $_____

0009 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 $_____

0010 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 $_____

0011 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 $_____

0012 OPTION NO. 5: Additional cost for all work required by the plans and specifications for southeast parking lot.

TOTAL OPTION NO. 5 $_____

0013 OPTION NO. 6: Additional cost for all work required by the plans and specifications for off-site demolition.

TOTAL OPTION NO. 6 $_____

TOTAL OPTION NOs. 1, 2, 3a, 3b, 3c, 4, 5 and 6 $_____

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.

APPLICATION OF WAGE DECISIONS

Solicitation No. DACA63-98-B-0040
Project: General Instruction Building - Phase I
Location: Fort Hood, Texas

1. Wage Decision **TX980051** Building Construction, is applicable to construction, alteration, or repair of buildings, installations within buildings, appurtenances to buildings, foundations for buildings, excavation and fill for buildings, and utilities within five feet from buildings.

2. Wage Decision **TX980043** Heavy and Highway Construction, is applicable to utilities more than five feet from buildings, and any other construction requirements not shown in paragraphs 1 above.

NOTE: THE WAGE DECISION NUMBER APPLICABLE TO THE WORK PERFORMED IS TO BE SHOWN ON THE PAYMENT RECORDS.

General Decision Number TX980051

Superseded General Decision No. TX970051

State: TEXAS

Construction Type:
BUILDING

County(ies):
BELL CORYELL

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

Modification Number	Publication Date
0	02/13/1998
1	**07/24/1998**

COUNTY(ies):
BELL CORYELL

ELEC0072A 09/04/1997

	Rates	Fringes
ELECTRICIANS	17.30	3.20+3.5%
CABLE SPLICERS	18.30	3.20+3.5%

---

* IRON0482B 06/01/1998

	Rates	Fringes
IRONWORKERS, Structural	15.85	4.05

SUTX1067A 11/16/1991

	Rates	Fringes
AIR CONDITIONING AND HEATING MECHANICS (Excluding Duct Work)	9.10	
BRICKLAYERS	14.00	
CARPENTERS (Including Drywall Hangers)	11.58	
CEMENT MASONS	10.50	
GLAZIERS	7.00	.46
INSULATION INSTALLERS (Batt and Blown)	8.31	.54

IRONWORKERS, Reinforcing	11.00	
LABORERS (Including Mason Tenders)	5.61	
LATHERS	15.33	
PAINTERS	8.32	.13
PLASTERERS	12.78	
PLUMBERS AND PIPEFITTERS (Excluding HVAC Work)	10.07	
POWER EQUIPMENT OPERATORS: Backhoes	8.54	
ROOFERS	7.78	
SHEET METAL WORKERS (Including HVAC Work)	9.79	
SOFT FLOOR LAYERS	13.46	.26
TILE SETTERS	15.00	.25

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

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial

contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

General Decision Number TX980043

Superseded General Decision No. TX970043

State: **TEXAS**

Construction Type:
HEAVY
HIGHWAY

County(ies):

BELL	CORYELL	TRAVIS
BEXAR	GUADALUPE	WILLIAMSON
BRAZOS	HAYS	
COMAL	MCLENNAN	

Heavy (excluding tunnels and dams) **and Highway Construction Projects** (does not include building structures in rest area projects). *NOT TO BE USED FOR WORK ON SEWAGE OR WATER TREATMENT PLANTS OR LIFT/PUMP STATIONS IN BELL, CORYELL, McLENNAN AND WILLIAMSON COUNTIES.

Modification Number	**Publication Date**
0	02/13/1998
1	**05/22/1998**

COUNTY(ies):

BELL	CORYELL	TRAVIS
BEXAR	GUADALUPE	WILLIAMSON
BRAZOS	HAYS	
COMAL	MCLENNAN	

* SUTX2042A 03/26/1998

	Rates	Fringes
AIR TOOL OPERATOR	8.08	
ASPHALT HEATER OPERATOR	11.00	
ASPHALT RAKER	8.00	
ASPHALT SHOVELER	7.97	
BATCHING PLANT WEIGHER	11.00	
CARPENTER	10.80	
CONCRETE FINISHER-PAVING	9.57	
CONCRETE FINISHER-STRUCTURES	8.83	
CONCRETE RUBBER	8.52	
ELECTRICIAN	16.25	

FLAGGER	6.86
FORM BUILDER-STRUCTURES	8.77
FORM LINER-PAVING & CURB	8.00
FORM SETTER-PAVING & CURB	8.68
FORM SETTER-STRUCTURES	8.73
LABORER-COMMON	7.12
LABORER-UTILITY	7.99
MECHANIC	12.15
OILER	11.40
SERVICER	8.44
PAINTER-STRUCTURES	10.00
PIPE LAYER	8.27
ASPHALT DISTRIBUTOR OPERATOR	9.70
ASPHALT PAVING MACHINE	9.26
BROOM OR SWEEPER OPERATOR	7.12
BULLDOZER	9.28
CONCRETE CURING MACHINE	7.79
CONCRETE FINISHING MACHINE	11.00
CONCRETE PAVING SAW	9.79
SLIPFORM MACHINE OPERATOR	11.15
CRANE, CLAMSHELL, BACKHOE, DERRICK, DRAGLINE, SHOVEL	10.12
FOUNDATION DRILL OPERATOR TRUCK MOUNTED	15.00
FRONT END LOADER	8.86
HOIST - DOUBLE DRUM & LESS	10.81
MIXER	7.12
MIXER - CONCRETE PAVING	11.00
MOTOR GRADER FINE GRADE	12.37
MOTOR GRADER	11.14
PAVEMENT MARKING MACHINE	8.31
PLANER OPERATOR	15.75
ROLLER, STEEL WHEEL PLANT-MIX PAVEMENTS	7.73
ROLLER, STEEL WHEEL OTHER FLATWHEEL OR TAMPING	7.33
ROLLER, PNEUMATIC, SELF PROPELLED	7.17
SCRAPERS	8.38
TRACTOR-CRAWLER TYPE	9.40
TRAVELING MIXER	7.92
TRENCHING MACHINE, HEAVY	9.92
WAGON-DRILL/BORING MACHINE	8.00
REINFORCING STEEL SETTER PAVING	14.50
REINFORCING STEEL SETTER STRUCTURES	10.61
STEEL WORKER-STRUCTURAL	11.73
SPREADER BOX OPERATOR	8.55

WORK ZONE BARRICADE	8.29
SIGN INSTALLER	7.97
TRUCK DRIVER-SINGLE AXLE LIGHT	8.32
TRUCK DRIVER-SINGLE AXLE HEAVY	7.954
TRUCK DRIVER-TANDEM AXLE SEMI-TRAILER	8.02
TRUCK DRIVER-LOWBOY/FLOAT	10.12
WELDER	11.02

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor

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

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U. S. Department of Labor
200 Constitution Avenue, N. W.
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

TABLE OF CONTENTS
SECTION 00800
SPECIAL CONTRACT REQUIREMENTS

1	52.0-4039	YEAR 2000 COMPLIANCE (JULY 1998)
2	52.0-4083	CORRESPONDENCE IDENTIFICATION (52.0000-4083)
3	52.1-4038 196	TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (OCT 1989) (ER 415-1-15) (52.0001-4038 1/96)
4	52.1-4050 196	PROCUREMENT AUTHORITY FOR FEDERAL INFORMATION RESOURCES
5	52.1-4063	VALUE ENGINEERING CONTRACTOR PROPOSAL - VECP (AUG 86) (52.0001-4063)
6	52.28-4000	HAZARDOUS MATERIALS ABATEMENT INSURANCE - (AUG 1997) (52.0028-4000)
7	52.211-10	COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)
8	52.211-13	TIME EXTENSIONS (APR 1984)
9	52.211-18	VARIATION IN ESTIMATED QUANTITY (APR 1984)
10	52.211-4406 196	LIQUIDATED DAMAGES--CONSTRUCTION (APR 1984) (52.0211-4406 1/96)
11	52.228-12	PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS (OCT 1995)
12	52.228-4005 L1	REQUIRED INSURANCE (APR 1984) (52.0228-4005 L1)
13	52.231-5000 efr	EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995) - EFARS
14	52.232-5000 efr	PAYMENT FOR MATERIALS DELIVERED OFFSITE (MAR 1995) - EFARS
15	52.236-14	AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)
16	52.236-4001 EBS	CONTRACT DRAWINGS, MAPS, AND SPECIFICATIONS (OCT 1996) (52.0236-4001 EBS
17	52.236-4004 196	PHYSICAL DATA (APR 1984) (52.0236-4004 196)
18	52.236-4005	SALVAGE MATERIALS AND EQUIPMENT (JAN 1965) (52.0236-4005)
19	52.236-4006 196	PAYMENT FOR UTILITY SERVICES (FAR 36.303(c)(6)) (52.0236-4006 196)
20	52.249-5000 efr	BASIS FOR SETTLEMENT OF PROPOSALS
21	52.236-4201	PERFORMANCE EVALUATION OF CONTRACTOR (52.0236-4201)

SECTION 00800

SPECIAL CONTRACT REQUIREMENTS

1 52.0-4039 YEAR 2000 COMPLIANCE (JULY 1998)

In accordance with FAR 39.106, the contractor shall ensure that with respect to any design, construction, goods, or services under this contract as well as any subsequent task/delivery orders issued under this contract (if applicable), all information technology contained therein shall be Year 2000 compliant. Specifically the contractor shall:

a. Perform, maintain, and provide an inventory of all major components to include structures, equipment, items, parts, and furnishings under this contract and each task/delivery order that may be affected by the Y2K compliance requirement.

b. Indicate whether each component is currently Year 2000 compliant or requires an upgrade for compliance prior to government acceptance.

(End of Paragraph)

2 52.0-4083 CORRESPONDENCE IDENTIFICATION (52.0000-4083)

a. The Contractor shall use a serial numbering system on all formal correspondence sent to the Contracting Officer or his representative. The Contractor will provide one original and two duplicate copies of all correspondence.

b. The Contractor may use a Request for Information (RFI) system for drawing/specification clarifications, subject to the following conditions:

(1) The Contractor shall use a sequential numbering system for all RFI's separate and apart from the correspondence numbering system.

(2) The Contractor shall provide one original and two copies of all RFI's.

(3) The Contractor shall designate ONE individual responsible person, subject to approval by the Contracting Officer, for reviewing and issuing RFI's.

(4) If a Network Analysis is required, all RFI's are to identify the NAS activities directly and/or indirectly affected by the RFI on the progress schedule. The Contractor should anticipate a minimum of 10 calendar days for Government review and response.

(5) No requests for deviations or variations from the contract by RFI will be allowed. Deviations/variations are to be submitted on ENG Form 4025 as described in Section 01300, SUBMITTAL PROCEDURES.

(6) The use of RFI's does not relieve the Contractor of his responsibility for reviewing the contract documents and coordinating the work to be performed. If it is determined by the Contracting Officer that the RFI system is being used for other that its intended purpose, the Contracting Officer has the authority to discontinue the use of the RFI's for the remainder of the contract.

(End of Statement)

3 52.1-4038 196 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (OCT 1989) (ER 415-1-15) (52.0001-4038 1/96)

a. This provision specifies the procedure for the determination of time extensions for unusually severe weather in accordance with the Contract Clause entitled "DEFAULT (FIXED PRICE CONSTRUCTION)". In order for the Contracting Officer to award a time extension under this clause, the Following conditions must be satisfied:

(1) The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe that the adverse weather anticipated for the project location during any given month.

(2) The unusually severe weather must actually cause a delay to completion of the project. The delay must be beyond the control and without the fault or negligence of the contractor.

b. The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or

similar data for the project location and will constitute the base line for monthly weather time evaluations. The contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER CALENDAR DAYS
WORK DAYS BASED ON (5) DAY WORK WEEK

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
4	4	4	4	6	4	3	3	4	4	3	4

c. Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month). be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph "b" above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled "DEFAULT (FIXED PRICE CONSTRUCTION)."
(END)

4 52.1-4050 196 PROCUREMENT AUTHORITY FOR FEDERAL INFORMATION RESOURCES

Pursuant to the Federal Information Resources Management Regulation (FIRMR), Section 201-39.5202-3, this acquisition is not being conducted under the FIRMR, however any modifications requiring Federal Information Processing (FIP) resources will be conducted under specific agency delegation of GSA's exclusive procurement authority for FIP resources. The specific GSA DPA case number is KAA-95-AD-012.

5 52.1-4063 VALUE ENGINEERING CONTRACTOR PROPOSAL - VECP (AUG 86) (52.0001-4063)

Reference the Contract Clause "VALUE ENGINEERING-CONSTRUCTION".
After receipt of an approved VECP modification signed by the Contracting Officer, the Contractor may include its share of the Instant Contract Savings as part of the next scheduled Progress Payment estimate.
Payment of the Contractor's share of the Instant Contract Savings may be withheld at the discretion of the Contracting Officer, until a revised NAS or BAR CHART for the affected activity has been submitted and approved.

(End of Clause)

6 52.28-4000 HAZARDOUS MATERIALS ABATEMENT INSURANCE - (AUG 1997) (52.0028-4000)

a. If hazardous materials (e.g. asbestos, lead-based paint, polychlorinated biphenyl (pcb) compounds) abatement/removal or any other work with hazardous materials is required under this contract and Comprehensive General Liability Insurance is required, the policy of insurance which covers the hazardous materials abatement/removal or other work with asbestos shall be a "per occurrence" policy as that term used in the insurance industry. A policy issued on a "claims made" basis or any other "short tail" basis will not be accepted.
b. The Comprehensive General Liability per occurrence policy shall be obtained by the prime Contractor if the hazardous materials abatement work is performed by the prime Contractor's own work force, or by an hazardous materials abatement subcontractor(s), if the hazardous materials abatement work is subcontracted. The Contractor shall insert in the subcontract a requirement for the hazardous materials abatement subcontractor(s) to provide and maintain the insurance required by this paragraph. The Contractor shall maintain a copy of the subcontractor's proof of required insurance, and shall make such copy available to the Contracting Officer upon request."

7 52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within TEN (10) calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than THE DATES OR THE NUMBER OF CALENDAR DAYS SET FORTH IN SECTION 01000 CONSTRUCTION SCHEDULE. . The time stated for completion shall include final cleanup of the premises.

(End of clause)

8 52.211-13 TIME EXTENSIONS (APR 1984)

Notwithstanding any other provisions of this contract, it is mutually understood that the time extensions for changes in the work will depend upon the extent, if any, by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the contract completion date will be extended only for those specific elements so delayed and that the remaining contract completion dates for all other portions of the work will not be altered and may further provide for an equitable readjustment of liquidated damages under the new completion schedule.

(End of clause)

9 52.211-18 VARIATION IN ESTIMATED QUANTITY (APR 1984)

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

(End of clause)

10 52.211-4406 196 LIQUIDATED DAMAGES--CONSTRUCTION (APR 1984) (52.0211-4406 1/96)

(a) If the Contractor fails to complete the work within the time specified in the contract, or any extension thereof, the Contractor shall pay to the Government as liquidated damages, the sum for each day of delay as set forth in the schedule given in Section 1000, "CONSTRUCTION SCHEDULE".

(b) If the Government terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the Government in completing the work.

(c) If the Government does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

(End of Clause)

11 52.228-12 PROSPECTIVE SUBCONTRACTOR REQUESTS FOR BONDS (OCT 1995)

In accordance with Section 806(a)(3) of Pub. L. 102-190, as amended by Sections 2091 and 8105 of Pub. L. 103-355, upon the request of a prospective subcontractor or supplier offering to furnish labor or material for the performance of this contract for which a payment bond has been furnished to the Government pursuant to the Miller Act, the Contractor shall promptly provide a copy of such payment bond to the requester.

(End of clause)

12 52.228-4005 L1 REQUIRED INSURANCE (APR 1984) (52.0228-4005 L1)

As a minimum and pursuant to contract clause entitled "Insurance--Work on a Government Installation", the contractor shall maintain the following insurance.

(a) Workmen's compensation and employers' liability insurance in compliance with applicable state statutes, with a minimum employers' liability coverage of $100,000.

(b) Comprehensive general liability insurance for bodily injury in the minimum limits of $500,000 per occurrence. No property damage liability insurance is required.

(c) Comprehensive automobile liability insurance covering the operation of all automobiles used in connection with the performance of the contract in the minimum limits of $200,000 per person and $500,000 per occurrence for bodily injury and $20,000 per occurrence for property damage.

13 52.231-5000 efr EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (MAR 1995) - EFARS

(a) This clause does not apply to terminations. See 52.249-5000, Basis for settlement of proposals and FAR Part 49.

(b) Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region VI. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

(c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

(d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data , or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet.

(End of clause)

14 52.232-5000 efr PAYMENT FOR MATERIALS DELIVERED OFFSITE (MAR 1995) - EFARS

(a) Pursuant to FAR clause 52.232-5, Payments Under Fixed Priced Construction Contracts, materials delivered to the contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the General Provisions are fulfilled. Payment for items delivered to locations other than the work site will be limited to: (1) materials required by the technical provisions; or (3) materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

(b) Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contractor and including the value of material and labor incorporated into the item. In addition to petroleum products, payment for materials delivered off-site is limited to the following items: None
%%

(End of clause)

15 52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)

(a) The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

(End of clause)

(R 7-603.30 1967 APR)
(R 7-2102.4 1976 OCT)

16 52.236-4001 EBS CONTRACT DRAWINGS, MAPS, AND SPECIFICATIONS (OCT 1996) (52.0236-4001 EBS)

(a) The Government--

(1) Will provide the Contractor, without charge, one set of contract drawings and one set of specifications in electronic format on a compact disk. It is the contractor's responsibility to reproduce a set of contract drawings from this compact disk. The Government will not give the contractor any hard copy paper drawings or specifications for any contract resulting from this solicitation.

(b) The Contractor shall--

(1) Check all drawings furnished immediately upon receipt;

(2) Compare all drawings and verify the figures before laying out the work;

(3) Promptly notify the Contracting Officer of any discrepancies; and

(4) Be responsible for any errors which might have been avoided by complying with this paragraph (b).

(c) Large scale drawings shall, in general, govern small scale drawings. Figures marked on drawings shall, in general, be followed in preference to scale measurements.

(d) Omissions from the drawings or specifications or the mis-description of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or mis-described details of the work, but shall be performed as if fully and correctly set forth and described in the drawings and specifications.

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

Title	File	and	Drawing No.
GENERAL INSTRUCTION BUILDING, PHASE I, FORT HOOD, KILLEEN, TEXAS			

The list of drawings and maps set out in the index on the drawings is hereby incorporated by reference into these specifications.

Schedules included in the drawings are for the purpose of defining requirements other than quantities.

(End of clause)

17 52.236-4004 196 PHYSICAL DATA (APR 1984) (52.0236-4004 196)

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

The physical conditions indicated on the drawings and in the specifications are the result of site investigations by surveys and borings.

(a) Weather conditions: n/a

(b) Transportation facilities: n/a

(c) Ground water levels: It has been observed that ground water levels in heavily timbered or grassed areas quite often undergo a significant temporary rise when the area is cleared and/or stripped. This increase in water level can hinder traffic and construction progress in the affected areas. The duration of the ground water rise varies considerably, depending on prevailing weather and/or climatic conditions. Ref: Yearbook of Agriculture, 1957, copy available for inspection in Fort Worth District office.

(End of clause)

(R 7-603.25 1965 JAN)

18 52.236-4005 SALVAGE MATERIALS AND EQUIPMENT (JAN 1965) (52.0236-4005)

The Contractor shall maintain adequate property control records for all materials or equipment specified to be salvaged. These records may be in accordance with the Contractor's system of property control, if approved by the property administrator. The contractor shall be responsible for the adequate storage and protection of all salvaged materials and equipment and shall replace, at no cost to the Government, all salvage materials and equipment which are broken or damaged during salvage operations as the result of his negligence, or while in his care.

19 52.236-4006 196 PAYMENT FOR UTILITY SERVICES (FAR 36.303(c)(6)) (52.0236-4006 196)

In accordance with Contract Clause 52.236-14, "Availability and use of Utility Services," water, gas, and electricity are available from Gorvernment-owned and operated systems and will be furnished without charge to the Contractor.

(End of clause)

20 52.249-5000 efr BASIS FOR SETTLEMENT OF PROPOSALS

"Actual costs will be used to determine equipment costs for a settlement proposal submitted on the total cost basis under FAR 49.206-2(b). In evaluating a terminations settlement proposal using the total cost basis, the following principles will be applied to determine allowable equipment costs:

(1) Actual costs for each piece of equipment, or groups of similar serial or series equipment, need not be available in the contractor's accounting records to determine total actual equipment costs.

(2) If equipment costs have been allocated to a contract using predetermined rates, those charges will be adjusted to actual costs.

(3) Recorded job costs adjusted for unallowable expenses will be used to determine equipment operating expenses.

(4) Ownership costs (depreciation) will be determined using the contractor's depreciation schedule (subject to the provisions of FAR 31.205-11).

(5) License, taxes, storage and insurance costs are normally recovered as an indirect expense and unless the contractor charges these costs directly to contracts, they will be recovered through the indirect expense rate."

(End of Statement)

21 52.236-4201 PERFORMANCE EVALUATION OF CONTRACTOR (52.0236-4201)

a. As a minimum, the Contractor's performance will be evaluated upon final acceptance of the work. However, interim evaluations (per delivery order, per quarter, etc.) may be prepared at any time during contract performance when determined to be in the best interest of the Government.

b. The format for the evaluation will be Department of Defense (DD) Form 2626. The Contractor will be rated either outstanding, above average, satisfactory, marginal, or unsatisfactory in the areas of Contractor Quality Control, Timely Performance, Effectiveness of Management,

Compliance with Labor Standards, and Compliance with Safety Standards. The Contractor will be advised in writing of an overall unsatisfactory rating prior to completing the evaluation.

c. In accordance with Defense Federal Acquisition Regulation Supplement (DFARS) 236.201(c)(2), all performance evaluations will be made available to all DoD Contracting offices for their future use in determining contractor responsibility.

(End of Paragraph)

END OF SECTION 00800

SECTION 01410 ENVIRONMENTAL PROTECTION
ATTACHMENT A

BASIC STORM WATER POLLUTION PREVENTION PLAN
FOR
GENERAL INSTRUCTION BUILDING (PHASE I), FORT HOOD, TEXAS

1.0 GENERAL

1.1 PROJECT DESCRIPTION. This project will include construction of a new facility and demolition of two small structures at Fort Hood, Texas. The new facilities will have classrooms, arms rooms, and access roads to prepare Fort Hood as a military mobilization and training center. Other supporting facilities will include intrusion detection system, fire protection, utilities such as electric service, water, sewer, and storm drainage. The demolition structures are one CMU latrine (Building 3273, 1984 square feet, built in 1983) and one wood loading dock (Building 3272, 378 square feet with a 1600 square feet canopy, built in 1984). The total area encompassed by the new facility sites are approximately 31.9 acres, all of which will be disturbed. The general location and boundary of the project area are shown on sheet C-1-Project Location Map.

1.2 STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODE. The construction activities associated with this project have the following SIC codes:

A. 1542- General Contractors- Nonresidential buildings, Other than Industrial Buildings and Warehouses
B. 1711- Concrete Work (includes asphalt, i.e. access drives and parking lots, culvert construction).
C. 9711- National Security

1.3 LOCATION. The central location of the new facility project site is at latitude 31^0 8' 26" N and longitude 97^0 47' 18'' W. It is north of Motor Pool Road, south of Battalion Ave., west of 72nd Street, and east of 305th Street. The demolition site is within the new facility project location.

1.4 RECEIVING WATERS. The storm drainage from the new facility empties into a box culvert west of 72nd Street. It flows in a trapezoidal channel until it reaches the east side of 87th Street. Then it flows east in an underground storm drainage system and appears again in a paved channel, east of 58th Street. Storm drainage from the new site will eventually outfall to an unnamed creek, east of Hood Road and north of Business Route 190. Then it flow southeast to South Nolan Creek, then Nolan Creek, and then to the Leon River.

2.0 SITE DESCRIPTION

2.1 EXISTING CONDITIONS. The new facility project site currently lies in an open and relatively flat field. The northern and the southern part of the site has approximately 1.5 % and 2.5 % grades, respectively. The storm runoff drains into drainage swales along both sides of the three asphalt roads. The runoff flows from the northwest and the southeast to a drainage swale which flows from southwest to northeast in the central portion of the site. Then it discharges via a 4-foot by 7-foot box culvert to a trapezoidal paved channel. The runoff coefficient at the existing site for the new facility is approximately 0.62.

2.2 FUTURE CONDITIONS. At completion of the grading and construction, most of the site runoff will drain east via the underground storm drainage system. Then it empties into a trapezoidal paved channel, east of 72nd Street via a 4-foot by 7-foot box culvert, west of 72nd Street. This channel drains almost 85% of site storm runoff . The other 15% on the southwestern portion of the site, empties into a 24-inch diameter storm drain pipe. It drains west to a unpaved drainage swale and towards Clear Creek Road. Runoff generally drains into curb inlets along perimeter roads at the facility and to surface inlets at areas away from the roads.

The finished grades of the new facility will typically range from 1.5 to 2.0 % in the paved areas, and slope at 5 % from the building perimeter. The overall site has a grade of approximately 1.25 %. Future storm drainage will be diverted to four separate storm drainage system off site.

Most of the site will be paved after completion of the new facility, and the runoff coefficient will change to 0.74.

2.3 CONSTRUCTION PHASING. Phase I construction of the General Instruction Building Project is projected to start in November 1998 and complete in November 1999. Phase II of the project contract is expected to be awarded in 2000.

The sequence of major activities associated with Phase I construction are described as follows:

A. Clearing and Grubbing.

B. Grading and Drainage

C. Construction of base bid which include storm water controls during construction of new facility

D. Construction of bid options

Bid Options for Phase I construction are as follows:

Option no. 1 -- Demolition of underground utilities on the project site and not under the building foot print.

Option no. 2 -- Construction of the extension of Support Avenue

Option no. 3a -- Landscaping (to be clarified in the Contractor's SWPPP)

Option no. 3b -- Landscaping (to be clarified in the Contractor's SWPPP)

Option no. 3c -- Landscaping (to be clarified in the Contractor's SWPPP)

Option no. 4 -- Construction of brick screen wall around exterior mechanical, electrical equipment, and trash dumpsters.

Option no. 5 -- Construction of the south parking lot

Option no. 6 -- All off site demolition

2.4 SOILS DATA. The following soils data are from the Soil Survey of Coryell County, Texas, issued March 1977 by the United States Department of Agriculture, Soil Conservation Service.

This site contains one soil type. The Topsey-Urban land complex association is characterized by deep and gently sloping land with slopes ranging from 3 to 8 percent, with an average of 4 percent. Typically, the surface layer is dark grayish brown clay loam and is approximately 7 inches deep. The subsoil measures approximately 22 inches and is grayish brown clay loam containing calcium carbonate concentrations and shale fragments. The underlying material consists of stratified layers of marl and shale. This soil type is generally well drained, however, permeability is moderately slow and occurs at the rate of 0.6 to 2.0 inches/hour. Availability of water is medium. Runoff is medium to rapid, and erosion hazard is severe. The root zone is easily penetrated by plant roots. Unified Soil Classification of this soil type is C. Potential for shrink-swell is moderate. Soil reaction (ph) ranges from 7.9 to 8.4.

2.5 DRAWINGS. The new and demolition project sites are depicted on sheet no. C-1, Project Location Map, and sheet no. C-2, Site Development Plan and Bid Options. Storm Water Control Plans (sheet nos. H-7 through H-12 and H-14), and Storm Water Controls Details (sheet no. H-15) are provided with this document.

3.0 EROSION AND SEDIMENT CONTROLS

3.1 TEMPORARY STABILIZATION: When construction activities cease for

periods greater than 14 days, or when there are contract delays in the turfing operation and a quick cover is required to prevent erosion, or when seasonal conditions preclude immediate permanent stabilization measures, the Contractor shall provide temporary soil stabilization for all unpaved, graded, and disturbed portions of the site as soon as practicable. Section 02940 - MULCHING FOR EROSION CONTROL provides a recommended method and consists of the following: till the soil to a depth of four inches, spread straw or hay mulch at a rate of 3 tons per acre, and anchor the mulch into place using a mulch anchoring machine equivalent to a disk harrow with cupped disks removed and replaced with straight rolling coulters spaced not more than eight inches apart.

3.2 PERMANENT STABILIZATION. The Contractor shall provide permanent stabilization on disturbed graded areas in no more than 14 days after construction activities have ceased. All unpaved and graded areas indicated on plans and disturbed areas resulting from the Contractor's operations shall receive turfing treatments as specified in specification section 02933 - ESTABLISHMENT OF TURF.

3.3 TEMPORARY SEDIMENT BASINS. The temporary sediment basin is not feasible for this project.

3.4 STRUCTURAL CONTROLS. The Contractors shall provide structural controls when contracting the new facility and demolishing the 2 structures during execution of base bid and all bid options. The Contractor shall use structural control details on sheet H-15 and other structural controls as approved by the Contracting Officer to prevent soil erosion. Structural or storm water controls shall be established at the project construction sites on base, at material borrow sites off base, and at locations for equipment maintenance. The type of structural controls shall be specified in the Contractor's detailed Storm Water Control Plans (see paragraph, CONTRACTOR COMPLIANCE).

4.0 STORM WATER MANAGEMENT CONTROLS

4.1 RUNOFF COMPUTATIONS. The runoff rate at the new facility site will increase from existing to future conditions. This computation is based on the new facility site area of 31.9 acres, a 10-year storm return frequency, storm duration of 20 minutes, and rainfall intensity of 4.9 inches per hour (in/hr). The Contractor shall determine the runoff rates from drainage areas at the graded site and provide such information in this paragraph of the Contractor's detailed Storm Water Pollution Plan (SWPPP) (see paragraph, CONTRACTOR COMPLIANCE).

4.2 OUTFALL VELOCITY DISSIPATION DEVICES. No energy dissipators will be required for the new storm drainage system most of the runoff will be discharged at an existing

culvert by 72nd Street. New storm drainage pipes, curb inlets, and culverts are adequately designed for erosion from inflow of the designed areas.

5.0 BEST MANAGEMENT PRACTICES (BMPs) DURING CONSTRUCTION

The Contractor or its subcontractors shall be responsible for eliminating or controlling pollution produced by storm water runoff. The Contractor shall discuss BMPs in the Contractor's detailed Storm Water Pollution Prevention Plan (SWPPP). The proposed BMPs are discussed in the following sections.

5.1 WASTE MATERIALS. Solid waste materials (trash and construction debris) shall be in covered waste containers. Waste containers shall be emptied regularly to avoid overflow. The disposal area of excavated material from the project construction shall not be utilized for waste disposal. Routine janitorial service shall be provided for all construction buildings and surrounding grounds. No construction waste materials, including concrete, shall be buried or otherwise disposed on site. All site personnel shall be briefed on correct procedures for solid waste disposal.

5.2 HAZARDOUS WASTE. All hazardous waste shall be handled, stored, and disposed in accordance with applicable federal, state, and local regulations and prior to all other construction activities. Prior to demolition of 2 structures under base bid, items containing regulated materials shall be removed. Chemical waste shall be stored in clearly labeled, corrosion-resistant containers, and stored in designated areas before removal from the site. Material in excess of job requirements shall not be stored on site. All site personnel shall be briefed on the correct procedures for hazardous waste disposal.

5.3 SANITARY WASTE. On-site sanitary facilities shall be established. Facility location, design, maintenance, and waste collection practices shall be in accordance with local regulations. Any temporary parking area to be used 30 calendar days or more for Contractor's equipment or personal vehicles shall be paved with temporary asphalt and it shall be removed by the Contractor upon completion of the project.

5.4 OFF-SITE VEHICLE TRACKING AND DUST. Every effort shall be made to keep vehicles from tracking soils from the construction and material borrow sites. Dust generation shall be controlled by sprinkling, chemical treatment, light bituminous treatment, or similar methods. Materials hauled from the construction site in open-bed vehicles shall be covered or otherwise stabilized to avoid loss during transport.

5.5 FERTILIZERS. If fertilizers are required by the contract, it shall be applied in accordance with the manufacturer's recommendations, i.e. in the stated amounts and only when weather conditions are appropriate.

5.6 CONSTRUCTION VEHICLE MAINTENANCE AND REPAIR. Specific areas shall be designated for equipment maintenance and repair. Locations of these areas shall be chosen to minimize potential impacts on receiving waters and storm water controls shall be provided at these locations. All construction vehicles shall be regularly inspected for leaks and receive regularly scheduled maintenance to reduce the potential for leaks.

Vehicle fueling shall be conducted in accordance with good safety practices to reduce the potential for leaks and spills. Only properly constructed fuel containers shall be used on site and shall be labeled and stored in accordance with applicable codes. Washing and curing waters shall be contained and discharged as site drainage is prohibited. The Contractor may construct a retention basin to contain the discharge. However, the Contractor shall dispose of the waste water from the retention pond off base at his or her own cost.

6.0 TIMING OF CONTROLS AND ACTIVITIES

Temporary and permanent stabilization shall be established as indicated in paragraph, EROSION AND SEDIMENT CONTROLS. When construction temporarily ceases, erosion control shall be established in accordance with the paragraph addressing, TEMPORARY STABILIZATION. The structural controls are required to be in-place prior to initiation of construction work at the project site.

7.0 COMPLIANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS

The project is in compliance with the National Environmental Policy Act of 1969. A preliminary assessment screening for the proposed General Instruction Building project at Fort Hood, Texas was conducted in June 1998. A Record of Environmental Consideration (REC) was prepared for the proposed project in 29 June 1998. The project site is located at a traditional non-hazardous area of the installation and it was a former site of a medical hospital complex. No hazardous materials have been stored at the surrounding areas of the proposed site. The proposed site meets the requirements for Categorical Exclusion A-7, Appendix A, C-1 in Army Regulations 200-2. The proposed project have no significant archeological resources and is not located in habitat of the threatened and endangered species.

In accordance with Army Regulation 200-1, all Department of Defense installations and their construction Contractors is required to comply with the Texas Administrative Code (TAC), county, and local applicable environmental regulations.

In compliance with the Clean Water Act, a construction site of 5.0 acres, or more, is required to obtain a National Pollutant Discharge Elimination System (NPDES) General Permits for Storm Water Discharges from Construction Sites. The Federal Register Notice, is published in Volume 63, Number 128, July 6, 1998.

8.0 MAINTENANCE AND INSPECTION PROCEDURES

The Contractor shall perform quality control on site. All the pollution prevention control measures shall be inspected at least once every seven (7) days and within 24 hours of any storm producing 0.5 inches or more of rainfall. The inspector shall thoroughly understand the requirements of the Contractor's detailed SWPPP and shall have a basic knowledge of the engineering principles for reducing runoff pollution. Temporary stabilization shall be inspected for erosion and soil loss from the site. Temporary erosion control measures shall be inspected for bare spots and washouts. Discharge points shall be inspected for signs of erosion or sediment associated with the discharge. Locations where vehicles enter and leave the site shall be checked for signs of off-site sediment tracking.

The Best Management Practices (BMP) and pollution control maintenance procedures shall be reviewed for adequacy by the Contractor during project execution. All deficiencies shall be noted in the inspection reports and corrections implemented within seven (7) calendar days. The inspection reports shall be posted on the project bulletin board and submitted to the Contracting Officer at project closeout. The PPP shall be revised as necessary. After final stabilization has been achieved, the Contractor shall inspect the site once a month until the final inspection and project acceptance by the Corps.

9.0 MATERIAL INVENTORY

All materials or substances brought on-site during construction shall have a Material Safety Data Sheet (MSDS) available for inspection by the Contracting Officer. These materials or substances may include, but are not limited to the following: concrete, paints, sealants, petroleum-based products, cleaning solvents, fertilizers, tar, asphalt, and steel reinforcing bars. The list of materials shall be stated in the Contractor's detailed Storm Water Management Plan. Project's phase of work awarded separately will require a separate list of materials.

10.0 NON-STORM WATER DISCHARGE

Non-storm water discharges shall not be allowed during construction of the project except for emergency fire-fighting flows and other flows permitted in 63 FR 128, state, and local regulations. In addition, any spill of a hazardous substance or oil in excess of reporting quantities shall be reported as required under 40 CFR 110. If any material or substance brought on-site should spill or leak, construction shall be ceased. Containment, clean-up, notification to the Contracting Officer, and documentation shall follow immediately.

11.0 CONTRACTOR COMPLIANCE

The Contractor shall use this basic SWPPP to prepare a detailed SWPPP that includes both narrative and drawings (Storm Water Control Plans) for Phase I General Instruction Building.

The detailed SWPPP shall also clarify the following items: (1) project start and completion dates, (2) sequence of construction activities, (3) bid options to be executed with the project (reference sheet no. C-2), (4) discussion of the Best Management Practices (BMPs) and implementation of BMPs during project execution, (5) list of materials brought on site including the MSDS, (6) runoff computation of each drainage area, and (7) revision of Storm Water Control Plans to specify storm water control details at the base bid and the executed option bid areas.

Being responsible for the daily operations at the construction site, the Contractor shall submit the detailed SWPPP (including the revised Storm Water Control Plans), and a Notice of Intent (NOI) for Storm Water Discharges Associated with Industrial Activity under the NPDES General Permit to EPA Region 6 in Dallas, Texas. The NOI (EPA Form 3510-6) shall be submitted no later than 48 hours before start of the construction. A separate NOI is required for each phase of construction work.

The Contractor's detailed SWPPP (including the revised Storm Water Control Plans) and a copy of submitted NOI shall be provided to the Contracting Officer before start of construction. A copy of the U.S.Army Corp of Engineers NOI (obtained from the Contracting Officer), the Contractor's NOI, and a brief project description shall be posted at the project bulletin board. The Contractor's detailed SWPPP shall be kept on site at all times. During construction, the Contractor shall perform work as required per paragraph, MAINTENANCE AND INSPECTION PROCEDURES in this section.

No later than 10 working days after final stabilization, the Contractor shall submit the Notice of Termination (NOT), EPA Form 3510-7 to EPA. Two copies of the submitted NOT shall be provided to the Contracting Officer's project file. EPA Forms are available on web site, http://www.epa.gov/earth1r6/6en/w/forms.htm.

OWNER CERTIFICATION
FOR
GENERAL INSTRUCTION BUILDING PHASE I , FORT HOOD, TEXAS

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

MICHAEL J. MOCEK, P.E.
DEPUTY DISTRICT ENGINEER,

Date Certified:_____

Attachments:

Sheet no. C-1, PROJECT LOCATION MAP
Sheet no. C-2, SITE DEVELOPMENT PLAN AND BID OPTIONS
Sheet no. H-7 through H-12 and H-14, STORM WATER CONTROL PLAN-I through PLAN-VI and PLAN-VIII
Sheet no. H-15, STORM WATER CONTROL DETAILS

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02050

DEMOLITION

09/91

PART
1 - GENERAL

1.1 REFERENCES

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

ENGINEERING MANUALS (EM)

\-EM 385-1-1-\	(1992) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 GENERAL REQUIREMENTS

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with \-EM 385-1-1-\, Section 23, Demolition, and other applicable Sections. In the interest of conservation, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as specified.

1.3 SUBMITTALS

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

SD-08 Statements\

Work Plan\; *FI0*\.

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, including procedures and methods to provide necessary supports, lateral bracing and shoring when required, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations in accordance with \-EM 385-1-1-\.

1.4 DUST CONTROL

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to

avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

1.5 PROTECTION

1.5.1 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, may be allowed to remain standing without additional bracing, shoring, of lateral support until demolished. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.5.2 Protection of Existing Property

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.5.3 Protection From the Weather

The interior of buildings to remain and salvageable materials and equipment shall be protected from the weather at all times.

1.5.4 Protection of Trees

Trees within the project site which might be damaged during demolition and which are indicated to be left in place shall be protected by a 6 foot high fence. The fence shall be securely erected to follow the outer perimeter branches __[AM#1] <u>of individual tree or clumps of trees</u>. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the Contracting Officer.

1.5.5 Environmental Protection

The work shall comply with the requirements of Section [AM#1] 01410-ENVIRONMENTAL PROTECTION.

1.6 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.7 USE OF EXPLOSIVES

Use of explosives will not be permitted.

1.8 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available upon notice to proceed, [AM#1] unless stated otherwise on the plans, or as directed otherwise by the contracting officer.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXISTING STRUCTURES

Existing structures indicated shall be removed to [AM#1] 3 feet below grade, if required. Interior walls, other than retaining walls and partitions, shall be removed to 3 feet below grade.__[AM#1] Basement slabs shall be broken up to permit drainage. Sidewalks, curbs, gutters and street light bases shall be removed as indicated.

3.2 UTILITIES

Disconnection of utility services, with related meters and equipment, are specified in Section 02685 - GAS DISTRIBUTION SYSTEM; 02730 - SANITARY SEWERS; 02660 - WATER LINES and 16370 - ELECTRICAL DISTRIBUTION SYSTEM, AERIAL AND 16375 - ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Existing utilities shall be removed as indicated. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area. [AM#1] A digging permit shall be obtained through the Ft. Hood, Department of Public Works, (telephone 254-287-9735.). No digging, trenching, or excavation operations shall start until an approved digging permit is obtained.

3.3 FILLING

Holes, open basements and other hazardous openings shall be filled in accordance with Section 02225 - EARTHWORK.

3.4 DISPOSITION OF MATERIAL

Title to material and equipment to be demolished, except Government salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Government will not be responsible for the condition, loss or damage to such property after notice to proceed.

3.4.1 Salvageable Items and Material

Contractor shall salvage items and material to the maximum extent possible.

3.4.1.1 Material Salvaged for the Contractor

Material salvaged for the Contractor shall be stored as approved by the Contracting Officer and shall be removed from Government property before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.

3.4.1.2 Items Salvaged for the Government

Salvaged items to remain the property of the Government shall be removed in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage shall be repaired or replaced to match existing items. Containers shall be properly identified as to contents. All designated items for salvage, reserved as property of the Government shall be delivered to the contracting officer.

3.4.1.3 Items Salvaged for the Using Service

The following items reserved as property of the using service will be removed prior to commencement of work under this contract.

3.4.1.4 Historical Items

Historical items shall be removed in a manner to prevent damage. The following historical items shall be delivered to the Government for disposition: Corner stones, contents of corner stones, and document boxes wherever located on the site.

3.4.2 Unsalvageable Material

Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of off government controlled property, at the expense and responsibility of the contractor. Combustible material shall be disposed of off government controlled property, at the expense and responsibility of the contractor.

3.5 CLEAN UP

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02051 - REMOVAL, RECYCLING AND DISPOSAL OF REGULATED MATERIALS PRIOR TO BUILDING DEMOLITION

PART 1 - GENERAL

1.1 REFERENCES

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

CODE OF FEDERAL REGULATIONS (CFR)

(OSHA STANDARDS)

\-29 CFR 1910-\	Occupational Safety and Health Standards
\-29 CFR 1926-\	Safety and Health Regulations for Construction

(ENVIRONMENTAL PROTECTION AGENCY (EPA) REGULATIONS)

\-40 CFR 82-\	Protection of Stratospheric Ozone
\-40 CFR 261-\	Identification and Listing of Hazardous Waste
\-40 CFR 262-\	Standards Applicable to Generators of Hazardous Waste
\-40 CFR 263-\	Standards Applicable to Transporters of Hazardous Waste
\-40 CFR 264-\	Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
\-40 CFR 268-\	Land Disposal Restrictions
\-40 CFR 270-\	EPA Administered Permit Programs: The Hazardous Waste Permit Program
\-40 CFR 273-\	Standards for Universal Waste Management
\-40 CFR 761-\	Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce and Use Prohibitions

(DEPARTMENT OF TRANSPORTATION (DOT) REGULATIONS)

\-49 CFR 171-\	General Information, Regulations and Definitions
\-49 CFR 173-\	Shippers - General Requirements for Shipments and Packagings

\-49 CFR 178-\	Specifications for Packagings

TEXAS ADMINISTRATIVE CODE (TAC)

Sections 335.91 - 335.94	Standards Applicable to Transporters of Hazardous Waste

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	Safety and Health Requirements Manual (Sep 96)

1.2 DEFINITIONS

1.2.1 Regulated Materials

Regulated materials other than ACM and LBP, that are generally present in items at military installations, include mercury, polychlorinated biphenyls (PCBs), trichlorobenzene (TCB) and/or diethylhexyl phthalate (DEPH), tritium (low-level radioactive gas), cesium (element may cause explosion with water), and ozone depleting chemicals (ODCs). Requirements for abatement of asbestos containing material (ACM), and worker protection in structures that have lead-containing paint (LCP), are covered in Sections \=02080=\ and \=02091=\, respectively.

1.2.2 Mercury (Hg)

Mercury is a metal that is liquid at room temperature with a small vapor pressure. Mercury-containing items addressed by this specification are thermostats and fluorescent light bulbs (see definition of mercury bulb thermostat and fluorescent light bulb below).

1.2.3 Polychlorinated Biphenyls (PCBs)

PCBs are defined in \-40 CFR 761-\. They are oily in pure form and prolong exposure have been known to increase the risk of cancer, and cause adverse reproductive and developmental defects in animals. PCB-containing items addressed by this specification are ballasts (see definition of Ballast below).

1.2.4 Ozone Depleting Chemicals (ODCs)

ODCs include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halon, tetra (and tri) chloroethane, carbon tetrachloride and all isomers of methyl chloroform. A complete list of ODCs addressed by this specification are in \-40 CFR 82-\ Subpart A, Appendixes A and B. Items potentially containing ODC's are refrigeration equipment for HVAC systems, freezers, refrigerators, drinking fountains, ice machines, beverage and refrigerated food dispensers, halon fire extinguishers and biomedical equipment.

1.2.5 Ballast

A ballast is a device used to give starting voltage and/or stabilizing current to a fluorescent light bulb. Ballasts are metal cases filled with a solid/semisolid asphalt/tar substance that contain a capacitor. The

capacitor may contain the following regulated materials: PCBs, TCB and/or DEPH.

Ballasts are either from 4-foot light fixtures made before 1985 or all other sizes light fixtures made before 1991.

1.2.6 Fluorescent Light Bulb

A light bulb (or tube) of a fluorescent lighting fixture (defined below).

1.2.7 Lighting Fixture

A unit containing a fluorescent light bulb, light reflector, casing and ballast.

1.2.8 Mercury Bulb Thermostat

A temperature control device containing a Hg ampule attached to a bimetallic sensing element.

1.2.9 Retorting Mercury

The retorting of mercury is a process whereby mercury is distilled from other materials by using heat. During the fluorescent light bulb recycling process, mercury is retorted from the phosphor powder that coats the inside of the glass.

1.2.10 Lighted Exit Signs and Smoke Detector

The lighted exit sign contains tritium and smoke detector contains cesium.

1.3 DESCRIPTION OF WORK

No environmental survey has been performed to identify items containing regulated materials in Buildings 3272 and 3273 at Fort Hood, Texas. Building 3272 is a loading dock facility that was built in 1984. It has 378 square feet (SF) building and an open area of 1600 SF covered by a canopy. Building 3273 is 530 SF CMU latrine that was built in 1983. All items containing regulated materials shall be removed prior to demolition of the two structures . For cost estimation purposes, an estimated quantity of itmes to be removed for both structures was prepared. The Contractor shall field verify and adjust actual abatement quantities with the Contracting Oficer. These items include 22 mercury-containing fluorescent light tubes, 11 (TCB or DEPH) light ballasts, 1 (ODC) air compressor with piping, 1 (ODC)water cooler, 1 thermostat with mercury switch, and 1 tritium-containing lighted exit signs. The Contractor shall remove these items and turn in to the DPW Classification Unit. The Contractor shall contact Mr. Alex Kachura, phone 254/287-8712 for requirements and arrangement for drop-off.

The Contractor shall purge the refrigerant, R-22 from the air compressor units and turn in the retrieved refrigerant to DPW Supply. Pre-arrangement for delivery of the refrigerant is necessary. Contact Mr. Bill Bodkin of DPW Environmental, phone no. 254/287-8713.

1.4 CONTRACTOR'S QUALIFICATIONS

The Contractor and subcontractors shall be familiar with \-40 CFR 273-\. The Contractor and subcontractors and shall have at least 2 years experience with fluorescent light ballasts (PCBs, TCB and/or DEPH) and fluorescent light tubes and thermostats (which contains Hg). The Contractor and subcontractors purging and reclaiming ODCs, shall be certified in accordance with \-40 CFR 82-\ and shall have at least 2 years experience. They shall also be familiar with other Federal, state and local regulations for work to be performed in this specification.

1.5 SUBMITTALS

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

SD-01 Data\

Qualifications\; *FIO*\.

The Contractor shall be familiar with \-40 CFR 273-\ and handling of mercury.

The Contractor shall have at least 2 years experience in handling PCBs.

The Contractor shall have at least 2 years experience in handling ODCs.

Certifications\; *FIO*\.

A copy of each technician's certification, required under \-40 CFR 82.161-\, who will be reclaiming ODCs.

A copy of each ODCs recovery and recycling equipment's certification in accordance with \-40 CFR 82.158-\.

A copy of each ODCs reclaimer's certification in accordance with \-40 CFR 82.164-\.

Licenses and Permits\; *FIO*\.

A copy of the state permit for hauling and transporting hazardous waste in accordance with \-40 CFR 263-\.

Plans\; *FIO*\.

A written Spill Prevention and Safety Plan shall be prepared in accordance with paragraph SPILLS AND SAFETY of this Section and submitted before the start of work.

Pollution Insurance\; *FIO*\.

A copy of the contractor's current environmental pollution liability insurance for the recycling and/or destruction facilities to ensure that the facility assumes full responsibility for compliance with all Federal,

State and local regulations pertaining to worker protection, work practices, site safety, transportation and disposal.

SD-08 Statements\

Contractor's Qualification\; *GA*\.

Documentation of Contractor's and subcontractor's work experience in removal, recycling and disposal of items containing Hg, PCB's and ODC's shall be submitted before the start of work.

SD-18 Records\

Closure Report\; *GA*\.

A closure report, including a statement of compliance, shall be prepared in accordance with paragraph CLOSURE REPORT of this Section and submitted in 5 working days after project completion.

1.6 WASTE MINIMIZATION, SALVAGE AND RECLAMATION

The Contractor shall practice waste minimization, salvage and reclamation of items containing regulated materials. The Contractor shall not dispose of any item in its entirety to the landfill or by incineration. Regulated materials placed in a landfill or incinerated shall be manifested in accordance with \-40 CFR 262-\ unless exemption is justified otherwise and approved by Contracting Officer.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 VERIFICATION OF REGULATED MATERIALS

Prior to start of work in this section, the Contractor shall field verify the locations, quantities, and the types of regulated items to be removed on the environmental drawings and the architectural, mechanical, electrical demolition plans. The Contractor shall notify the Contracting Officer of any discrepancies or conflicts before performing work specified in this section.

3.2 REMOVAL, HANDLING AND PACKAGING

3.2.1 Fluorescent Light Bulbs

The Contractor shall remove fluorescent light bulbs from the lighting fixtures and place them in shipping containers in accordance with \-49 CFR 178-\ properly packaged to avoid breakage. Broken fluorescent lights bulbs shall be placed in a container labeled "Broken Fluorescent Bulbs" container(s) and manifested for transport and disposal in accordance with \-40 CFR 262-\, \-40 CFR 263-\, and \-40 CFR 264-\.

3.2.2 Ballasts

The Contractor shall remove all ballasts from the lighting fixtures, (segregate them according to the type of regulated material only if

required by the recycling facility), and place into containers in accordance with \-49 CFR 178-\ for shipping. A typical container shall not hold more than 250 ballasts or the weight of a container shall not exceed 450 kilograms. All leaking ballasts shall be placed in container with absorbent such as vermiculite and managed in accordance with \-40 CFR 761-\.

3.2.3 Mercury Bulb Thermostats

The Contractor shall remove and handle mercury bulb thermostats in accordance with \-40 CFR 273-\. Leaking or broken ones shall be placed in a container with absorbent such as vermiculite, and manifested for transportation and disposal in accordance with \-40 CFR 262-\, \-40 CFR 263-\, and \-40 CFR 264-\.

3.2.4 Units Containing ODCs

Prior to removal of items that contains ODCs, the Contractor shall purge the drinking water coolers and handle ODCs in accordance with \-40 CFR 82-\ Subpart F.

3.2.5 Air Compressors (A/C) Containing R-22

Prior to removal of A/C that contains R-22, the Contractor shall purge the A/C. The purged A/C shall become the property of the Contractor and they shall be salvaged to the maximum extent possible to avoid disposal at a landfill.

3.2.6 Lighted Exit Signs

They shall be segregated and securely packaged in labeled containers. The container void shall be filled with vermiculite, or other suitable fire-retardant material. Shipping labels “Used Lighted Exit Signs contain Tritium” shall be affixed to the container.

3.3 LABELING AND RECORD KEEPING

Labeling and record keeping of regulated materials to be salvaged, recycled, incinerated or placed in a landfill shall be in accordance with \-40 CFR 262-\, \-40 CFR 263-\, \-40 CFR 264-\, \40 CFR 273\, and all other applicable Federal, State and local regulations.

3.4 SPILLS AND SAFETY

The Contractor shall prepare, maintain and implement a Spill Prevention Plan. The plan shall establish policies and procedures to protect worker, prevent spills, minimize impact of spill on its surroundings, and methods to clean-up. The plan shall address the safety and health concerns in accordance with \-29 CFR 1926-\ in event of a spill. The following items shall be discussed in the plan: Worker Protection requirement during removal of regulated materials; Contractor to clean-up spill; verification of clean-up completion by the Contracting Officer; method, equipment and material necessary to clean-up spill; reporting requirements to Federal, state, local, and Contracting Officer by phone and in writing. The plan shall be kept on-site. The plan shall address that spills greater than the

Reportable Quantities (RQ) for specific chemicals, i.e. 1 pound of PCBs shall be reported to National Response Center (1-800-424-8802).

3.5 STORAGE

A temporary storage area shall be provided by the Contractor and approved by the Contracting Officer. Storage time limits are 30 days for ballasts containing PCBs (\-40 CFR 761-\) and 1 year for thermostats containing Hg (\-40 CFR 273-\). Regulated materials must be removed from the site before final project acceptance by the Government.

3.6 TRANSPORTATION

Materials shall be transported by a licensed, hazardous waste hauler. Operating procedures shall be enforced by the Contractor to prevent spillage in accordance with \-49 CFR 171-\ and \-40 CFR 173-\. The hauler shall not store regulated materials longer than 10 days in accordance with \-40 CFR 263-\ and \-40 CFR 273-\. Vehicle loading, vehicle placarding, waste tracking, notification and record keeping shall be in accordance with all applicable Federal, State and local regulations.

3.7 RECYCLING/DESTRUCTION FACILITY

The Contractor shall only ship items to facilities which have environmental pollution liability insurance coverage and operating in accordance with \-40 CFR 261-\, \-40 CFR 268-\ and \-40 CFR 270-\.

3.8 CLOSURE REPORT

The Contractor shall prepare and submit a closure report to the Contracting Officer after project completion and prior to final payment (see submittal requirement in paragraph 1.5 SUBMITTAL of this section). The report shall contain: (1) A signed cover letter certifying completion of work described herein; (2) The signed statement of compliance appended herein; (3) A brief narrative describing worker protection and waste removal, handling, packaging, transportation, separation and ultimate end (recycled, destroyed and/or disposed); (4) A description of accidents, ruptures, leaks, subsequent response procedures and cleanup; and (5) Final disposition documentation including a copy of notifications, signed manifest of waste (if applicable) and signed certificates or receipts of recycling or destruction).

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

STATEMENT OF COMPLIANCE

I hereby certify that:

(1) the appropriate state manifest form has been completely and properly filled out;

(2) the packing, marking, labeling and placarding of the waste meets all applicable regulations;

(3) the waste transportation, recycling, destruction and disposal meets all applicable Federal, State and local regulations.

Name _____

Title _____

Date _____

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02080

WORKER PROTECTION DURING DEMOLITION OF STRUCTURES THAT CONTAIN ASBESTOS CONTAINING MATERIAL (ACM)

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 Z9.2-\	(1979; R 1991) Fundamentals Governing the Design and Operation of Local Exhaust Systems
\-ANSI Z87.1-\	(1989; Errata; Z87.1a) Occupational and Educational Eye and Face Protection
\-ANSI Z88.2-\	(1992) Respiratory Protection

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 732-\	(1995) Aging Effects of Artificial Weathering on Latex Sealants
\-ASTM D 522-\	(1993a) Mandrel Bend Test of Attached Organic Coatings
\-ASTM D 1331-\	(1989; R 1995) Surface and Interfacial Tension of Solutions of Surface-Active Agents
\-ASTM D 2794-\	(1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
\-ASTM D 4397-\	(1991) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
\-ASTM E 84-\	(1995a) Surface Burning Characteristics of Building Materials
\-ASTM E 96-\	(1995) Water Vapor Transmission of Materials
\-ASTM E 119-\	(1995a) Fire Tests of Building Construction and Materials
\-ASTM E 736-\	(1992) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

\-ASTM E 1368-\	(1990) Visual Inspection of Asbestos Abatement Projects

CODE OF FEDERAL REGULATIONS (CFR)

\-29 CFR 1910-\	Occupational Safety and Health Standards
\-29 CFR 1926-\	Safety and Health Regulations for Construction
\-40 CFR 61-\	National Emissions Standards for Hazardous Air Pollutants
\-40 CFR 763-\	Asbestos
\-42 CFR 84-\	Approval of Respiratory Protective Devices
\-49 CFR 107-\	Hazardous Materials Program Procedures
\-49 CFR 171-\	General Information, Regulations and Definitions
\-49 CFR 172-\	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
\-49 CFR 173-\	Shippers - General Requirements for Shipments and Packagings

COMPRESSED GAS ASSOCIATION (CGA)

\-CGA G-7-\	(1990) Compressed Air for Human Respiration
\-CGA G-7.1-\	(1989) Commodity Specification for Air

ENVIRONMENTAL PROTECTION AGENCY (EPA)

\-EPA 340/1-90-018-\	(1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance
\-EPA 340/1-90-019-\	(1990) Asbestos/NESHAP Adequately Wet Guidance
\-EPA 560/5-85-024-\	(1985) Guidance for Controlling Asbestos-Containing Materials in Buildings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 701-\	(1996) Methods of Fire Test for Flame-Resistant Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

\-NIOSH Pub No. 84-100-\	(1984; Supple 1985, 1987, 1988 & 1990) NIOSH Manual of Analytical Methods

UNDERWRITERS LABORATORIES (UL)

\-UL 586-\	(1990; Rev Apr 1995) High-Efficiency, Particulate, Air Filter Units

UNITED STATES ARMY CORPS OF ENGINEERS (USACE)

\-EM 385-1-1-\	(1996) Safety and Health Requirements Manual

1.2 DEFINITIONS

Adequately Wet: A term defined in \-40 CFR 61-\, Subpart M, and \-EPA 340/1-90-019-\ meaning to sufficiently mix or penetrate with liquid to prevent the release of particulate. If visible emissions are observed coming from asbestos-containing material (ACM), then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wetted.

Aggressive Method: Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact asbestos-containing material (ACM).

Amended Water: Water containing a wetting agent or surfactant with a surface tension of at least 29 dynes per square centimeter when tested in accordance with \-ASTM D 1331-\.

Asbestos: Asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophylite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated and/or altered.

Asbestos-Containing Material (ACM): Any materials containing more than one percent asbestos.

Asbestos Fiber: A particulate form of asbestos, 5 micrometers or longer, with a length-to-width ratio of at least 3 to 1.

Authorized Person: Any person authorized by the Contractor and required by work duties to be present in the regulated areas.

Building Inspector: Individual who inspects buildings for asbestos and has EPA Model Accreditation Plan (MAP) "Building Inspector" training; accreditation required by \-40 CFR 763-\ Subpart E, Appendix C.

Certified Industrial Hygienist (CIH): An Industrial Hygienist certified in the practice of industrial hygiene by the American Board of Industrial Hygiene.

Class I Asbestos Work: Activities defined by OSHA involving the removal of thermal system insulation (TSI) and surfacing ACM.

Class II Asbestos Work: Activities defined by OSHA involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos- containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic. Certain "incidental" roofing materials such as mastic, flashing and cements when they are still intact are excluded from

Class II asbestos work. Removal of small amounts of these materials which would fit into a glovebag may be classified as a Class III job.

Class III Asbestos Work: Activities defined by OSHA that involve repair and maintenance operations, where ACM, including TSI and surfacing ACM, is likely to be disturbed. Operations may include drilling, abrading, cutting a hole, cable pulling, crawling through tunnels or attics and spaces above the ceiling, where asbestos is actively disturbed or asbestos-containing debris is actively disturbed.

Class IV Asbestos Work: Maintenance and custodial construction activities during which employees contact but do not disturb ACM and activities to clean-up dust, waste and debris resulting from Class I, II, and III activities. This may include dusting surfaces where ACM waste and debris and accompanying dust exists and cleaning up loose ACM debris from TSI or surfacing ACM following construction.

Clean room: An uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

Competent Person: In addition to the definition in \-29 CFR 1926-\ Section .32(f), a person who is capable of identifying existing asbestos hazards as defined in \-29 CFR 1926-\ Section .1101, selecting the appropriate control strategy, has the authority to take prompt corrective measures to eliminate them and has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training; accreditation required by \-40 CFR 763-\ Subpart E, Appendix C.

Contractor/Supervisor: Individual who supervises asbestos abatement work and has EPA Model Accreditation Plan "Contractor/Supervisor" training; accreditation required by \-40 CFR 763-\, Subpart E, Appendix C.
Critical Barrier: One or more layers of plastic sealed over all openings into a regulated area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a regulated area from migrating to an adjacent area.

Decontamination Area: An enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

Demolition: The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

Disposal Bag: A \^0.15 mm^\ \~6 mil~\ thick, leak-tight plastic bag, pre-labeled in accordance with \-29 CFR 1926-\ Section .1101, used for transporting asbestos waste from containment to disposal site.

Disturbance: Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM. Disturbance includes cutting away small amounts of ACM, no greater than the amount which can be contained in one standard sized glovebag or waste bag in order to access a building component. In no event shall the amount of ACM so disturbed exceed that which can be contained in one glovebag or waste disposal bag which shall not exceed \^1.5 m^\ \~60 inches~\ in length and width.

Equipment Room or Area: An area adjacent to the regulated area used for the decontamination of employees and their equipment.

Employee Exposure: That exposure to airborne asbestos that would occur if the employee were not using respiratory protective equipment.

Fiber: A fibrous particulate, 5 micrometers or longer, with a length to width ratio of at least 3 to 1.

Friable ACM: A term defined in \-40 CFR 61-\ Subpart M and \-EPA 340/1-90-018-\ meaning any material which contains more than 1 percent asbestos, as determined using the method specified in \-40 CFR 763-\ Subpart F, Appendix A, Section 1, Polarized Light Microscopy (PLM), that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. If the asbestos content is less than 10 percent, as determined by a method other than point counting by PLM, the asbestos content shall be verified by point counting using PLM.

Glovebag: Not more than a \^1.5 by 1.5 m^\ \~60 by 60 inch~\ impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled.

High-Efficiency Particulate Air (HEPA) Filter: A filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

Homogeneous Area: An area of surfacing material or thermal system insulation that is uniform in color and texture.

Industrial Hygienist: A professional qualified by education, training, and experience to anticipate, recognize, evaluate, and develop controls for occupational health hazards.

Intact: ACM which has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix. Removal of "intact" asphaltic, resinous, cementitious products does not render the ACM non-intact simply by being separated into smaller pieces.

Model Accreditation Plan (MAP): USEPA training accreditation requirements for persons who work with asbestos as specified in \-40 CFR 763-\ Subpart E, Appendix C.

Modification: A changed or altered procedure, material or component of a control system, which replaces a procedure, material or component of a required system.

Negative Exposure Assessment: A demonstration by the Contractor to show that employee exposure during an operation is expected to be consistently below the OSHA Permissible Exposure Limits (PELs).

NESHAP: National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at \-40 CFR 61-\ Subpart M.

Non-friable ACM: A NESHAP term defined in \-40 CFR 61-\ Subpart M and \-EPA 340/1-90-018-\ meaning any material containing more than 1 percent asbestos, as determined using the method specified in \-40 CFR 763-\ Subpart F, Appendix A, Section 1, Polarized Light Microscopy, that, when dry, cannot be crumbled, pulverized or reduced to powder by hand pressure.

Nonfriable ACM (Category I): A NESHAP term defined in \-40 CFR 61-\ Subpart M and \-EPA 340/1-90-018-\ meaning asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the method specified in \-40 CFR 763-\ Subpart F, Appendix A, Section 1, Polarized Light Microscopy.

Nonfriable ACM (Category II): A NESHAP term defined in \-40 CFR 61-\ Subpart M and \-EPA 340/1-90-018-\ meaning any material, excluding Category I non-friable ACM, containing more than 1 percent asbestos, as determined using the methods specified in \-40 CFR 763-\ Subpart F, Appendix A, Section 1, Polarized Light Microscopy, that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Permissible Exposure Limits (PELs):

a. PEL-Time weighted average(TWA): Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an eight hour time weighted average (TWA), as determined by the method prescribed in \-29 CFR 1926-\ Section .1101, Appendix A, or the current version of NIOSH analytical method 7400.

b. PEL-Excursion Limit: An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes as determined by the method prescribed in \-29 CFR 1926-\ Section .1101, Appendix A, or the current version of NIOSH analytical method 7400.

Regulated Area: An OSHA term defined in \-29 CFR 1926-\ Section .1101 meaning an area established by the Contractor to demarcate areas where Class I, II, and III asbestos work is conducted; also any adjoining area where debris and waste from such asbestos work accumulate; and an area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed, the permissible exposure limit.

Removal: All operations where ACM is taken out or stripped from structures or substrates, and includes demolition operations.

Repair: Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM attached to structures or substrates. (If the amount of asbestos so "disturbed" cannot be contained in one standard glovebag or waste bag, Class I precautions are required).

Spills/Emergency Cleanups: Cleanup of sizable amounts of asbestos waste and debris which has occurred, for example, when water damage occurs in a building, and sizable amounts of ACM are dislodged. A Competent Person evaluates the site and ACM to be handled, and based on the type, condition and extent of the dislodged material, classifies the cleanup as Class I, II, or III. Only if the material was intact and the cleanup involves mere contact of ACM, rather than disturbance, could there be a Class IV classification.

Surfacing ACM: Asbestos-containing material which contains more than 1% asbestos and is sprayed-on, troweled-on, or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, or other purposes.

Thermal system insulation (TSI) ACM: ACM which contains more than 1% asbestos and is applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components to prevent heat loss or gain or water condensation.

Transite: A generic name for asbestos cement wallboard and pipe.

Worker: Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required by \-29 CFR 1926-\ Section .1101 to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation required by \-40 CFR 763-\ Subpart E, Appendix C, if required by the OSHA Class of work to be performed or by the state where the work is to be performed.

1.3 DESCRIPTION OF WORK

This section describes worker protection required during demolition of structures (in Base Bid) which contain presumed ACM for the Phase I of construction of General Instruction Building at Fort Hood, Texas. No ACM abatement is required prior to demolition of Building 3272 that was built in 1984 and Building 3273 that was built in 1983. Building 3272 is a loading dock with 378 square feet (SF) building area and an open area of 1600 SF covered by a canopy. Building 3273 is a 530 SF CMU latrine. This section described procedures and equipment that required to protect workers and occupants of adjacent areas from exposure to airborne asbestos fibers. The Contractor shall provide specific operational procedures to protect workers during demolition of structures in the required Accident Prevention Plan, (see paragraph SAFETY AND HEALTH PROGRAM AND PLANS) to address worker protection and training to minimize exposure to airborne asbestos. The Contractor’s Competent Person will be adequate to implement worker protection when no ACM removal is needed prior to demolition. If other ACM are identified, and ACM abatement is necessary, the Contractor shall prepare a Contractor’s Asbestos Abatement Plan. ACM shall be abated and disposed of in accordance with all requirements described this section.

Initial asbestos survey of these two buildings was performed by Radian Inc. from October 1996 to August 1997. No follow-up survey was conducted to verify Radian’s findings by USACE because these structures are not identified in the project scoping document. Bulk samples collected and analyzed during the Radian’s survey have detected no ACM on the drywalls of both structures. Floor tiles with and roofing materials are not typically ACM because they are constructed in the mid 1980s. However, Radian’s survey report listed building putties and caulks to be presumed asbestos containing materials (PACM). Radian’s ACM survey report are available for reference on request from the Contracting Officer or the designated representative.

The building putties and caulks are non-friable and in good condition. The NESHAP permits the non-friable and intact ACM to stay in-place with the structures during demolition if the process does not render the asbestos fibers friable. The Contractor shall have the structures and debris adequately wetted during demolition. The debris shall be adequately wetted and covered during loading and transportation to minimize release of asbestos fiber.

The ACM contaminated debris shall be placed into the special waste trench at Fort Hood Sanitary Landfill. The Contractor shall notify Texas

Department of Health in writing at least 10 working days prior to start of demolition work (see paragraph 1.14). The notification form shall be signed by a representative of Environmental Office at Fort Hood (POC: Mr. Bill Bodkin, phone no. 254/287-8713).

1.3.1 Abatement Work Tasks

No ACM abatement prior to demolition. No work task is listed in Table 1. If the Contractor finds ACM, it shall be abated prior to demolition in accordance with this section. The ACM item to be abated shall be listed in Table 1.

1.3.2 Unexpected Discovery of Asbestos

For any previously untested building components suspected to contain asbestos and located in areas impacted by the work, the Contractor shall notify the Contracting Officer who will have the option of ordering up to one bulk sample to be obtained at the Contractor's expense and delivered to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)" and analyzed by PLM at no additional cost to the Government. Any additional components identified as ACM that have been approved by the Contracting Officer for removal shall be removed by the Contractor and will be paid for by an equitable adjustment to the contract price under the CONTRACT CLAUSE titled "changes". Sampling activities undertaken to determine the presence of additional ACM shall be conducted by personnel who have successfully completed the EPA Model Accreditation Plan (MAP) "Building Inspector" training course required by \-40 CFR 763-\ Subpart E, Appendix C.

1.4 SUBMITTALS

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

SD-01 Data\

Materials and Equipment\; *FIO*\.

Manufacturer's catalog data for all materials and equipment to be used in the work, including brand name, model, capacity, performance characteristics and any other pertinent information. Test results and certificates from the manufacturer of encapsulants substantiating compliance with performance requirements of this specification. Data shall include, but shall not be limited to, the following items:

a. Air monitoring equipment

b. Respirators

c. Personal protective clothing and equipment
   (1) Coveralls
   (2) Underclothing
   (3) Other work clothing

(4) Foot coverings
(5) Hard hats
(6) Eye protection
(7) Other items required and approved by Contractor’s Competent Person

d. Disposal Containers

e. Sheet Plastic

k. Wetting Agent
(1) Amended Water

l. Other items

SD-08 Statements\

Qualifications\; *GA*\.

A written report providing evidence of qualifications for personnel, facilities and equipment assigned to the work (see paragraph 1.5, QUALIFICATIONS).

Training Program\; *FIO*\.

A copy of the written project site-specific training material as indicated in \-29 CFR 1926-\ Section .1101 that will be used to train onsite employees. This training document shall be signed by the Contractor's Competent Person.

Medical Requirements\; *FIO*\.

Physician written result.

SD-09 Reports\

Air Monitoring\; *GA*\.

Provide requirement for air monitoring for worker protection during demolition of structures with non-friable PACM permitted by NESHAP. If ACM abatement is necessary, reference paragraph, AIR MONITORING, for details to be included with this submittal.

Local Exhaust Ventilation\; *FIO*\.

If applicable, provide pressure differential recordings.

Licenses, Permits and Notifications\; *GA*\.

Licenses, permits and notifications as described in paragraph 1.14, LICENSES, PERMITS AND NOTIFICATIONS.

SD-13 Certificates\

Vacuum, Filtration and Ventilation Equipment\; *FIO*\.

If applicable to the project, provide manufacturer's certifications showing compliance with \-ANSI Z9.2-\ for:

a. Vacuums.
b. Water filtration equipment.
c. Ventilation equipment.
d. Other equipment required to contain airborne asbestos fibers.

SD-18 Records\

Respiratory Protection Program\; *GA*\.

Records of the respirator program as described in paragraph 1.12, RESPIRATORY PROTECTION PROGRAM.

Safety/Accident Prevention and Abatement Plan\; *GA*\.

Requirements are described in paragraph 1.7, Safety and Health Program and Plans. Describe as required for worker protection during demolition of structures with non-friable PACM permitted by NESHAP.

Closure Report\; *GA*\.

If applicable, a copy of each waste shipment record, weigh bill, delivery ticket, daily narrative log of work, problems and resolution, exposure assessment, daily monitoring and analytical results shall be provided with the Closure Report. Report shall indicate results for monitoring workers during demolition of structures that contain non-friable PACM as permitted by NESHAP.

1.5 *QUALIFICATIONS*\

1.5.1 Written Qualifications and Organization Report

The Contractor shall furnish a written qualifications and organization report providing evidence of qualifications of the Contractor, Contractor's Project Supervisor, Designated Competent Person, supervisors and workers; Certified IH (person assigned to project and firm name); independent testing laboratory (including name of firm, principal and analyst(s) who will perform analyses); all subcontractors to be used including disposal transportation and disposal facility firms, subcontractor supervisors, subcontractor workers; and any others assigned to perform asbestos abatement and support activities. The report shall include an organization chart showing the Contractor's staff organization for this project by name and title, chain of command and reporting relationship with all subcontractors. The report shall be signed by the Contractor, the Contractor's onsite project manager, Designated Competent Person, Designated IH, designated testing laboratory and the principals of all subcontractors to be used. The Contractor shall include the following statement in the report: "By signing this report I certify that the personnel I am responsible for during the course of this project fully understand the contents of \-29 CFR 1926-\ Section .1101, \-40 CFR 61-\ Subpart M, and the federal, state and local requirements specified in paragraph SAFETY AND HEALTH COMPLIANCE for those asbestos abatement activities that they will be involved in."

1.5.2 Specific Requirements

The Contractor shall designate in writing, personnel meeting the following qualifications:

a. Designated Competent Person: The name, address, telephone number, and resume of the Contractor's Designated Competent Person shall be provided. Evidence that the full-time Designated Competent Person is qualified in accordance with \-29 CFR 1926-\ Sections .32 and .1101, has EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by \-40 CFR 763-\ Subpart E, Appendix C, and is experienced in the administration and supervision of asbestos abatement projects, including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, notification of other employees onsite, etc. The duties of the Competent Person shall include the following: controlling entry to and exit from the regulated area; supervising any employee exposure monitoring required by \-29 CFR 1926-\ Section .1101; ensuring that all employees working within a regulated area wear the appropriate personal protective equipment (PPE), are trained in the use of appropriate methods of exposure control, and use the hygiene facilities and decontamination procedures specified; and ensuring that engineering controls in use are in proper operating conditions and are functioning properly. This Designated Competent Person shall be responsible for compliance with applicable federal, state and local requirements, the Contractor's Accident Prevention Plan and Asbestos Hazard Abatement Plan. The Designated Competent Person shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Contractor shall submit evidence that this person has a minimum of 2 years of on-the-job asbestos abatement experience relevant to OSHA competent person requirements. The Designated Competent Person shall be onsite at all times during the conduct of this project.

b. Project and Other Supervisors: The Contractor shall provide the name, address, telephone number, and resume of the Project Supervisor and other supervisors who have responsibility to implement the Accident Prevention Plan, including the Asbestos Hazard Abatement Plan and Activity Hazard Analyses, the authority to direct work performed under this contract and verify compliance and have EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by \-40 CFR 763-\ Subpart E, Appendix C. The Project Supervisor and other supervisors shall provide, and the Contractor shall submit, the "Contractor/Supervisor" course completion certificate and the most recent certificate for required refresher training with the employee "Certificate of Worker Acknowledgment" required by this paragraph. The Contractor shall submit evidence that the Project Supervisor has a minimum of 2 years of on-the-job asbestos abatement experience relevant to project supervisor responsibilities and the other supervisors have a minimum of 1 years on-the-job asbestos abatement experience commensurate with the responsibilities they will have on this project.

c. Certified Industrial Hygienist (CIH) and IH Technicians (IHT) : The Contractor shall provide the name, address, telephone number, documentation of certification and other specified information of the designated CIH selected to prepare the Contractor's Asbestos Hazard Abatement Plan, prepare and perform training, direct air monitoring and assist the Contractor's Competent Person in implementing and ensuring that safety and health requirements are complied with during asbestos abatement. The CIH shall be certified by the American Board of Industrial Hygiene (ABIH), have a minimum of 2 years of comprehensive experience in planning and overseeing asbestos abatement activities and have EPA Model Accreditation Plan (MAP) "Contractor/Supervisor" training accreditation required by \-40 CFR 763-\ Subpart E, Appendix C. The CIH shall provide the Contractor, and the Contractor shall submit, a copy of the training certification for the “Contractor/Supervisor” course and required refresher training course along with a copy of the CIH’s current ABIH certification. The CIH shall be completely independent from the Contractor according to federal, state, or local regulations; that is, shall not be a Contractor's employee or be an employee or principal of a firm in a business relationship with the Contractor negating such independent status. The CIH shall be available for visits to the project site for emergencies or as needed by the IHT. The Contractor shall submit, the name, address, telephone numbers and resumes and air monitoring license of the IHT who will be performing the onsite tasks under the direction of the CIH. The IHT shall have a minimum of 2 full years of practical onsite asbestos abatement experience and have a current Texas Department of Health Air Monitoring Technician License. The IHT shall be completely independent of the Contractor and will be onsite during the entire abatement project.

d. Asbestos Abatement Workers: Asbestos abatement workers shall meet the requirements contained in \-29 CFR 1926-\ Section .1101, \-40 CFR 61-\ Subpart M and other applicable federal, state and local requirements. Worker training documentation shall be provided as required on the "Certificate of Workers Acknowledgment" in this paragraph.

e. Worker Training and Certification of Worker Acknowledgment: Training documentation shall be required for each employee who will perform OSHA Class I, Class II, Class III, or Class IV asbestos abatement operations. Such documentation shall be submitted on a Contractor generated form titled "Certificate of Workers Acknowledgment" to be completed for each employee in the same format and containing the same information as the example certificate at the end of this section. All training course completion certificates (initial and most recent update refresher) required by the information checked on the form shall be attached.

f. Physician: The Contractor shall provide the name, medical qualifications, address, telephone number and resume of the physician who will or has performed the medical examinations and evaluations of the persons who will conduct the asbestos abatement work tasks. The physician shall be currently licensed by the state where the workers will be or have been examined, have expertise in pneumoconioses and shall be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with \-29 CFR 1926-\ Section .1101 and paragraph MEDICAL REQUIREMENTS. The physician shall be familiar with the site's hazards and the scope of this project. The medical consultant's name, qualifications, and knowledge of the site's conditions and proposed activities shall be included in the Accident Prevention Plan.

g. First Aid and CPR Trained Persons: The names of at least two persons who are currently trained in first aid and CPR by the American Red Cross or other approved agency shall be designated and shall be onsite at all times during site operations. They shall be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of \-29 CFR 1910-\ Section .1030 and shall be included in the Contractor's Bloodborne Pathogen Program. These persons may perform other duties but shall be immediately available to render first aid when needed. A copy of each designated person's current valid First Aid and CPR certificate shall be provided.

h. Independent Testing (including air monitoring) Laboratory and Technicians: The Contractor shall provide the name, address/telephone number, and license number with expiration date of the independent testing laboratory and technicians selected to perform the sample analyses and report the results. The testing laboratory and technicians shall be completely independent from the Contractor as recognized by federal, state or local regulations. Written verification of the following criteria, signed by the testing laboratory principal and the Contractor, shall be submitted:

(1) Phase contrast microscopy (PCM): The laboratory is fully equipped and the analyst (name shall be provided) possess demonstrated proficient in conducting PCM of airborne samples using the methods specified by \-29 CFR 1926-\ Section .1101, OSHA method ID-160, the most current version of \-NIOSH Pub No. 84-100-\ Method 7400, and \-NIOSH Pub No. 84-100-\ Method 7402, transmission electron microscopy (TEM); the laboratory is currently judged proficient (classified as acceptable) in counting airborne asbestos samples by PCM by successful participation in each of the last 4 rounds in the American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing (PAT) Program; the names of the selected microscopists who will analyze airborne samples by PCM with verified documentation of their proficiency to conduct PCM analyses by being judged proficient in counting samples as current participating analysts in the AIHA PAT Program, and having successfully completed the Asbestos Sampling and Analysis course (NIOSH 582 or equivalent) with a copy of course completion certificate provided; when the PCM analysis is to be conducted onsite, documentation shall be provided certifying that the onsite analyst has successfully participated in the laboratory’s PAT program or is currently proficient in the AIHA Asbestos Analyst Registry (AAR) Program.

(2) Polarized light microscopy (PLM): The laboratory is fully equipped and proficient in conducting PLM analyses of suspect ACM bulk samples in accordance with \-40 CFR 763-\ Subpart E, Appendix E; the laboratory is currently accredited by NIST under the NVLAP for bulk asbestos analysis and will use analysts (names shall be provided) with demonstrated proficiency to conduct PLM to include its application to the identification and quantification of asbestos content. The laboratory is proficient in conducting analysis using an improved EPA test method titled “Method for the Determination of Asbestos in Bulk Building Materials, EPA/600/R-93/116”. This method provides more precise analysis of floor tiles and bulk materials where multiple layers are present.

(3) Transmission electron Microscopy (TEM): The laboratory is fully equipped and proficient in conducting TEM analysis of airborne samples

using the mandatory method specified by \-40 CFR 763-\ Subpart E Appendix E; the laboratory is currently accredited by HIST under the NVLAP for airborne sample analysis of asbestos by TEM; the laboratory will use analysts (names shall be provided) that are currently evaluated as competent with demonstrated proficiency under the NIST NVLAP for airborne sample analysis of asbestos by TEM.

(4) PCM/TEM: The laboratory is fully equipped and the analyst (name shall be provided) have demonstrated proficiency in conducting TEM analysis of airborne samples using \-NIOSH Pub No. 84-100-\ Method 7400 PCM and \-NIOSH Pub No. 84-100-\ Method 7402 (TEM confirmation of asbestos content of PCM results) from the same filter.

i. Disposal Facility, Transporter: The Contractor shall provide written evidence that the landfill to be used is approved for asbestos disposal by the state and local regulatory agencies. Copies of signed agreements between the Contractor (including subcontractors and transporters) and the asbestos waste disposal facility to accept and dispose of all asbestos containing waste generated during the performance of this contract shall be provided. Qualifications shall be provided for each subcontractor or transporter to be used, indicating previous experience in transport and disposal of asbestos waste to include all required state and local waste hauler requirements for asbestos. The Contractor and transporters shall meet the DOT requirements of \-49 CFR 171-\, \-49 CFR 172-\, and \-49 CFR 173-\ as well as registration requirements of \-49 CFR 107-\ and other applicable state or local requirements. The disposal facility shall meet the requirements of \-40 CFR 61-\ Sections .154 or .155 as required in \-40 CFR 61-\ Section .150(b) and other applicable state or local requirements.

1.5.3 Federal, State or Local Citations on Previous Projects

The Contractor and all subcontractors shall submit a statement, signed by an officer of the company, containing a record of any citations issued by Federal, State or local regulatory agencies relating to asbestos activities (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations). If there are none, there will be a negative declaration signed by an officer of the company.

1.5.4 Liability

The Contractor shall obtain without additional expense to the Government, the asbestos abatement liability insurance as required by this contract. The Contractor shall assume full responsibility and liability for the compliance of all Federal, state, and local regulations pertaining to work practices, hazard communication, hauling, disposal, and protection of workers, visitors to the project site, and persons occupying area adjacent to the project site.

1.6 REGULATORY REQUIREMENTS

In addition to detailed requirements of this specification, work performed under this contract shall comply with \-EM 385-1-1-\, applicable federal, state, and local laws, ordinances, criteria, rules and regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. This includes, but is not limited to, OSHA standards, \-29 CFR 1926-\, especially Section .1101, \-40 CFR 61-\ Subpart M and \-40 CFR 763-\. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply. The following state and local laws, rules and regulations regarding demolition, removal, encapsulation, construction alteration, repair, maintenance, renovation, spill/emergency cleanup, housekeeping, handling, storing, transporting and disposing of asbestos material apply: Texas Asbestos Health Protection Rules.

1.7 SAFETY AND HEALTH PROGRAM AND PLANS

The Contractor's Designated IH shall develop and submit a written comprehensive site-specific Accident Prevention Plan at least 30 days prior to the preconstruction conference (or approved as by the Contracting Officer).

The Accident Prevention Plan shall address all requirements of \-EM 385-1-1-\, Appendix A, covering onsite work to be performed by the Contractor and all subcontractors. The Accident Prevention Plan shall incorporate an Asbestos Hazard Abatement Plan (only applicable if ACM abatement is needed), and Activity Hazard Analyses as separate appendices into one site specific Accident Prevention Plan document. Any portions of the Contractor's overall Safety and Health Program that are referenced in the Accident Prevention Plan, e.g., respirator program, hazard communication program, confined space entry program, etc., shall be included as appendices to the Accident Prevention Plan. The plan shall take into consideration all the individual asbestos abatement work tasks identified in Table 1 (if applicable to the project). The plan shall be prepared, signed, sealed with certification number, and dated by the Contractor's Designated IH, Competent Person, and Project Supervisor, if ACM abatement is needed for the project.

1.7.1 The Asbestos Hazard Abatement Plan Appendix (applicable when ACM abatement is required)

The Asbestos Hazard Abatement Plan appendix to the Accident Prevention Plan shall include, but not be limited to, the following:

a. The personal protective equipment to be used (i.e. coveralls, head coverings, etc.);

b. The location and description of regulated areas including clean and dirty areas, access tunnels, and decontamination unit (clean room, shower room, equipment room, storage areas such as load-out unit);

c. Initial exposure assessment in accordance with \-29 CFR 1926-\ Section .1101;

d. Level of supervision;

e. Method of notification of other employers at the worksite;

f. Abatement method to include containment and control procedures;

g. Interface of trades involved in the construction;

h. Sequencing of asbestos related work;

i. Storage and disposal procedures and plan;

j. Type of wetting agent, asbestos encapsulant, and strippable coating to be used;

k. Location of local exhaust equipment;

l. Air monitoring methods (personal and environmental);

m. Bulk sampling and analytical methods (if required and shall be approved by Contracting Officer);

n. A detailed description and illustration of the method to be employed in order to control the spread of ACM wastes and airborne fiber concentrations;

o. Fire and medical emergency response procedures;

p. The security procedures to be used for all regulated areas.

q. Type of hygiene facility to be used.

r. Type of surfaces which required precleaning (see paragraph 3.5)

s. Table 1 for all abatement work tasks (see paragraph 1.3.1, Abatement Work Tasks.

1.7.2 The Activity Hazard Analyses Appendix

Activity Hazard Analyses, for each major phase of work, shall be submitted and updated during the project. The Activity Hazard Analyses format shall be in accordance with \-EM 385-1-1-\ (Figure 1-1). The analysis shall define the activities to be performed for a major phase of work, identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the Activity Hazard Analyses has been accepted and a preparatory meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activities, including the onsite Government representatives. The Activity Hazard Analyses shall be continuously reviewed and, when appropriate, modified to address changing site conditions or operations.

1.8 PRECONSTRUCTION CONFERENCE AND ONSITE SAFETY

The Contractor and the Contractor's Designated Competent Person, Project Supervisor, and Designated IH shall meet with the Contracting Officer prior

to beginning work at a safety preconstruction conference to discuss the details of the Contractor's submitted Accident Prevention Plan to include the Asbestos Hazard Abatement Plan and Activity Hazard Analyses appendices. Deficiencies in the Accident Prevention Plan will be discussed and the Accident Prevention Plan shall be revised to correct the deficiencies and resubmitted for acceptance. Any changes required in the specification as a result of the Accident Prevention Plan shall be identified specifically in the plan to allow for free discussion and acceptance by the Contracting Officer prior to the start of work. Onsite work shall not begin until the Accident Prevention Plan has been accepted. A copy of the written Accident Prevention Plan shall be maintained onsite. Changes and modifications to the accepted Accident Prevention Plan shall be made with the knowledge and concurrence of the Designated IH, the Project Supervisor, Designated Competent Person, and the Contracting Officer. Should any unforeseen hazard become evident during the performance of the work, the CIH shall bring such hazard to the attention of the Project Supervisor, Designated Competent Person, and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, all necessary action shall be taken by the Contractor to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Once accepted by the Contracting Officer, the Accident Prevention Plan, including the Asbestos Hazard Abatement Plan and Activity Hazard Analyses will be enforced as if an addition to the contract. Disregard for the provisions of this contract or the accepted Accident Prevention Plan shall be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

1.9 SECURITY

Fenced and/or locked security area shall be provided for each regulated area. A log book shall be kept documenting entry into and out of the regulated area. Entry into regulated areas shall only be by personnel authorized by the Contractor and the Contracting Officer. Personnel authorized to enter regulated areas shall be trained, be medically evaluated, and wear the required personal protective equipment, for the specific regulated area to be entered.

1.10 *MEDICAL REQUIREMENTS*\

Medical requirements shall conform to \-29 CFR 1926-\ Section .1101.

1.10.1 Medical Examinations

Before being exposed to airborne asbestos fibers, workers shall be provided with a medical examination as required by \-29 CFR 1926-\ Section .1101 and other pertinent state or local requirements. This requirement must have been satisfied within the last 12 months. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. X-ray films of asbestos workers shall be identified to the consulting radiologist and medical record jackets shall be marked with the word "asbestos."

1.10.1.1 Information Provided to the Physician

The Contractor shall provide the following information in writing to the examining physician:

a. A copy of \-29 CFR 1926-\ Section .1101 and Appendices D, E, G, and I;

b. A description of the affected employee's duties as they relate to the employee's exposure;

c. The employee's representative exposure level or anticipated exposure level;

d. A description of any personal protective and respiratory equipment used or to be used;

e. Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

1.10.1.2 Written Medical Opinion

For each worker, a written medical opinion prepared and signed by a licensed physician indicating the following:

a. Summary of the results of the examination.

b. The potential for an existing physiological condition that would place the employee at an increased risk of health impairment from exposure to asbestos.

c. The ability of the individual to wear personal protective equipment, including respirators, while performing strenuous work tasks under cold and/or heat stress conditions.

d. A statement that the employee has been informed of the results of the examination, provided with a copy of the results, informed of the increased risk of lung cancer attributable to the combined effect of smoking and asbestos exposure, and informed of any medical condition that may result from asbestos exposure.

1.10.2 Medical and Exposure Records

The Contractor shall maintain complete and accurate records of each employee's medical examinations, medical records and exposure data as required by \-29 CFR 1910-\ Section .1910.20 and \-29 CFR 1926-\ Section .1101 for a period of 30 years after termination of employment. Records of the required medical examinations and exposure data shall be made available, for inspection and copying, to the Assistant Secretary of Labor for Occupational Safety and Health (OSHA) or authorized representatives of the employee and an employee's physician upon request of the employee or former employee. A copy of the required medical certification for each employee shall be maintained on file at the worksite for review, as requested by the Contracting Officer or the representatives.

1.11 *TRAINING PROGRAM*

1.11.1 General

The Contractor shall establish a training program as specified by EPA Model Accreditation Plan (MAP), training requirements at \-40 CFR 763-\ Subpart E, Appendix C, the State of Texas regulation no. 25 TAC 295 ((Texas Asbestos Health Protection Rules), OSHA requirements at \-29 CFR 1926-\ Section .1101(k)(9), and this specification. Contractor employees shall complete the required training for the type of work they are to perform and such training shall be documented and provided to the Contracting Officer as specified in paragraph QUALIFICATIONS.

1.11.2 Project Specific Training

Prior to commencement of work, each worker shall be instructed by the Contractor's Designated IH and Competent Person in the following project specific training:

a. The hazards and health effects of the specific types of ACM to be abated;

b. The content and requirements of the Contractor's Accident Prevention Plan to include the Asbestos Hazard Abatement Plan and Activity Hazard Analyses and site-specific safety and health precautions;

c. Hazard Communication Program;

d. Hands-on training for each asbestos abatement technique to be employed;

e. Heat and/or cold stress monitoring specific to this project;

f. Air monitoring program and procedures;

g. Medical surveillance to include medical and exposure record keeping procedures;

h. The association of cigarette smoke and asbestos-related disease;

I. Security procedures;

j. Specific work practice controls and engineering controls required for each Class of work in accordance with \-29 CFR 1926-\ Section .1101.

1.12 *RESPIRATORY PROTECTION PROGRAM*

The Contractor's Designated IH shall establish in writing, and implement a respiratory protection program in accordance with \-29 CFR 1926-\ Section .1101, \-29 CFR 1910-\ Section .134, \-ANSI Z88.2-\, \-CGA G-7-\, \-CGA G-7.1-\. The Contractor's Designated IH shall establish minimum respiratory protection requirements based on measured or anticipated levels of airborne asbestos fiber concentrations encountered during the performance of the asbestos abatement work. The Contractor's respiratory protection program shall include, but not be limited to, the following elements:

a. The company policy, used for the assignment of individual responsibility, accountability, and implementation of the respiratory protection program.

b. The standard operating procedures covering the selection and use of respirators. Respiratory selection shall be determined by the hazard to which the worker is exposed.

c. Medical evaluation of each user to verify that the worker may be assigned to an activity where respiratory protection is required.

d. Training in the proper use and limitations of respirators.

e. Respirator fit-testing, i.e., quantitative, qualitative and individual functional fit checks.

f. Regular cleaning and disinfection of respirators.

g. Routine inspection of respirators during cleaning and after each use when designated for emergency use.

h. Storage of respirators in convenient, clean, and sanitary locations.

I. Surveillance of regulated area conditions and degree of employee exposure (e.g., through air monitoring).

j. Regular evaluation of the continued effectiveness of the respiratory protection program.

k. Recognition and procedures for the resolution of special problems as they affect respirator use (e.g., no facial hair that comes between the respirator face piece and face or interferes with valve function; prescription eye wear usage; contact lenses usage; etc.).

l. Proper training in putting on and removing respirators.

1.12.1 Respiratory Fit Testing

A qualitative or quantitative fit test conforming to \-29 CFR 1926-\ Section .1101, Appendix C shall be conducted by the Contractor's Designated IH for each Contractor worker required to wear a respirator, and for the Contracting Officer and authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test shall be performed for each worker wearing a negative-pressure respirator prior to initially wearing a respirator on this project and every 6 months thereafter. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permitted to be worn, or of full-face piece air purifying respirators where they are worn at levels at which half-face piece air purifying respirators are permitted. If physical changes develop that will affect the fit, a new fit test for the worker shall be performed. Functional fit checks shall be performed by employees each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.12.2 Respirator Selection and Use Requirements

The Contractor shall provide respirators, and ensure that they are used as required by \-29 CFR 1926-\ Section .1101 and in accordance with the manufacturer's recommendations. Respirators shall be approved by the Mine Safety and Health Administration and the National Institute for

Occupational Safety and Health (MSHA/NIOSH), under the provisions of \-42 CFR 84-\, for use in environments containing airborne asbestos fibers. Personnel who handle ACM, enter regulated areas that require the wearing of a respirator, or who are otherwise carrying out abatement activities that require the wearing of a respirator, shall be provided with approved respirators that are fully protective of the worker at the measured or anticipated airborne asbestos concentration level to be encountered. For air-purifying respirators, the particulate filter portion of the cartridges or canister approved for use in airborne asbestos environments shall be high-efficiency particulate air (HEPA). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type shall be made by the Contractor's Designated IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered. All recommendations made by the Contractor's Designated IH to downgrade respirator type shall be submitted in writing to the Contracting Officer. The Contractor's Designated Competent Person in consultation with the Designated IH, shall have the authority to take immediate action to upgrade or downgrade respiratory type when there is an immediate danger to the health and safety of the wearer. Respirators shall be used in the following circumstances:

a. During all Class I asbestos jobs (Not applicable to this project).

b. During all Class II work where the ACM is not removed in a substantially intact state.

c. During all Class II which is not performed using wet methods. Respirators need not be worn during removal of ACM from sloped roofs when a negative exposure assessment has been made and ACM is removed in an intact state.

d. During all Class II asbestos jobs where the Contractor does not produce a negative exposure assessment.

e. Where TSI or surfacing ACM is being disturbed (not applicable to this project).

f. During all work where employees are exposed above the PEL-TWA or PEL-Excursion Limit.

g. In emergencies

1.12.3 Class I Work (not applicable to this project)

1.12.4 Class II Work (applicable when ACM abatement is needed)

The Contractor shall provide a half-mask air purifying respirator, other than a disposable respirator, equipped with high-efficiency filters whenever the employee performs Class II asbestos jobs where the Contractor does not produce a negative exposure assessment.

1.12.5 Sanitation

Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

1.13 HAZARD COMMUNICATION PROGRAM

A hazard communication program shall be established and implemented in accordance with \-29 CFR 1926-\ Section .59. Material safety data sheets (MSDSs) shall be provided for all hazardous materials brought onto the worksite. One copy shall be provided to the Contracting Officer's onsite Representative and one copy shall be included in the Contractor's Hazard Communication Program.

1.14 *LICENSES, PERMITS AND NOTIFICATIONS*

1.14.1 General Requirements

Necessary licenses, permits and notifications shall be obtained in conjunction with the project's asbestos abatement, transportation and disposal actions and timely notification furnished of such actions as required by federal, state, regional, and local authorities. The Contractor shall notify in writing, the Texas Department of Health, Division of Occupational Health, Asbestos Program Branch, Austin, Texas, at least 20 working days prior to the commencement of work in accordance with \-40 CFR 61-\ Subpart M, and state and local requirements to include the mandatory "Notification of Demolition and Renovation Record" form and other required notification documents. Notification shall be signed by the representative of Environmental Office, mailed by Certified Mail, and with Return Receipt Requested. The Contractor shall furnish copies of the receipts to the Contracting Officer, in writing, prior to the commencement of work. Local fire department shall be notified 3 days before fire-proofing material is removed from a building and the notice shall specify when the material contains asbestos. A copy of the rental company's written acknowledgment and agreement shall be provided as required by paragraph Rental Equipment. For licenses, permits and notifications that the Contractor is responsible for obtaining, the Contractor will pay any associated fees or other costs incurred.

1.14.2 Litigation and Notification

The Contractor shall notify the Contracting Officer if any of the following occur:

a. The Contractor or any of the subcontractors are served with notice of violation of any law, regulation, permit or license which relates to this Contract;

b. Proceedings are commenced which could lead to revocation of related permits or licenses; permits, licenses or other Government authorizations relating to this Contract are revoked;

c. Litigation is commenced which would affect this contract;

d. The Contractor or any of the subcontractors become aware that their equipment or facilities are not in compliance or may fail to comply in the future with applicable laws or regulations.

1.15 PERSONAL PROTECTIVE EQUIPMENT

One complete sets of personal protective equipment shall be made available to the Contracting Officer and authorized visitors for entry to the regulated area. Contracting Officer and authorized visitors shall be provided with training equivalent to that provided to Contractor employees in the selection, fitting, and use of the required personal protective equipment and the site safety and health requirements. Contractor workers shall be provided with personal protective clothing and equipment and the Contractor shall ensure that it is worn properly. The Contractor's Designated IH and Designated Competent Person supervisor shall select and approve all the required personal protective clothing and equipment to be used.

1.15.1 Respirators

See paragraph RESPIRATORY PROTECTION PROGRAM.

1.15.2 Whole Body Protection

Personnel exposed to airborne concentrations of asbestos that exceed the PELs, or for all OSHA Classes of work for which a required negative exposure assessment is not produced, shall be provided with whole body protection and such protection shall be worn properly. The Contractor's Designated IH and Competent Person supervisor shall select and approve the whole body protection to be used. The Competent Person shall examine work suits worn by employees at least once per work shift for rips or tears that may occur during performance of work. When rips or tears are detected while an employee is working, rips and tears shall be immediately mended, or the work suit shall be immediately replaced. Disposable whole body protection shall be disposed of as asbestos contaminated waste upon exiting from the regulated area. Reusable whole body protection worn shall be either disposed of as asbestos contaminated waste upon exiting from the regulated area or be properly laundered in accordance with \-29 CFR 1926-\ Section .1101. Whole body protection used for asbestos abatement shall not be removed from the worksite by a worker to be cleaned. All recommendations made by the Contractor's Designated IH to downgrade whole body protection shall be submitted in writing to the Contracting Officer. The Contractor's Designated Competent Person in consultation with the Designated IH, shall have the authority to take immediate action to upgrade or downgrade whole body protection when there is an immediate danger to the health and safety of the wearer.

1.15.2.1 Coveralls

Disposable-breathable coveralls with a zipper front shall be provided by the Contractor and identified on the Contractor’s Asbestos Hazard Abatement Plan. Sleeves shall be secured at the wrists, and foot coverings secured at the ankles.

1.15.2.2 Underwear

Disposable underwear shall be provided and they shall be disposed as asbestos contaminated waste. If reusable underwear are used, they shall be disposed of as asbestos contaminated waste or laundered in accordance with \-29 CFR 1926-\ Section .1101. Asbestos abatement workers shall not remove contaminated reusable underwear worn during abatement of ACM from the site to be laundered.

1.15.2.3 Work Clothing

An additional coverall shall be provided when the abatement and control method employed does not provide for the exit from the regulated area directly into an attached decontamination unit. Cloth work clothes shall be provided for wear under the protective coverall and foot coverings when work is being conducted in low temperature conditions. Cloth work clothes shall be either disposed of as asbestos contaminated waste or properly laundered in accordance with \-29 CFR 1926-\ Section .1101.

1.15.2.4 Gloves

Gloves shall be provided to protect the hands. Where there is the potential for hand injuries (i.e., scrapes, punctures, cuts, etc.) a suitable glove shall be provided and used.

1.15.2.5 Foot Coverings

Cloth socks shall be provided and worn next to the skin. Footwear, as required by OSHA and \-EM 385-1-1-\, that is appropriate for safety and health hazards in the area shall be worn. Rubber boots shall be used in moist or wet areas. All reusable footwear removed from the regulated area shall be thoroughly decontaminated or disposed of as ACM waste. All disposable protective foot covering shall be disposed of as ACM waste. If rubber boots are not used, disposable foot covering shall be provided.

1.15.2.6 Head Covering

Hood type disposable or reusable head covering shall be provided. The type of head covering to be used shall be identified in the Contractor’s Asbestos Hazard Abatement Plan. In addition, protective head gear (hard hats) shall be provided as required. Hard hats shall only be removed from the regulated area after being thoroughly decontaminated.

1.15.2.7 Protective Eye Wear

Eye protection provided shall be in accordance with \-ANSI Z87.1-\.

1.16 HYGIENE FACILITIES AND PRACTICES

The Contractor shall establish a decontamination area for the decontamination of employees, material and equipment. The Contractor shall ensure that employees enter and exit the regulated area through the decontamination area. The Contractor shall indicate the type of hygiene facility to be used in the Contractor’s Asbestos Hazard Abatement Plan.

1.16.1 Shower Facilities

Shower facilities, when provided, shall comply with \-29 CFR 1910-\ Section .141(d)(3).

1.16.2 3-Stage Decontamination Area (not applicable to this project)

1.16.3 Load-Out Unit (applicable when ACM abatement is needed)

A temporary load-out unit that is adjacent and connected to the regulated area and access tunnel shall be provided. Utilization of prefabricated units shall be noted in the Contractor's Asbestos Hazard Abatement Plan and shall have prior approval of the Contracting Officer. The load-out unit shall be attached in a leak-tight manner to each regulated area. Surfaces of the load-out unit and access tunnel shall be adequately wet-wiped 2 times after each shift change. Materials used for wet wiping shall be disposed of as asbestos contaminated waste.

1.16.4 Single Stage Decontamination Area

A decontamination area (equipment room/area) shall be provided for Class II asbestos work operations where exposures exceed the PELs or where there is no negative exposure assessment produced before the operation. The equipment room or area shall be adjacent to the regulated area for the decontamination of employees, material, and their equipment which is contaminated with asbestos. The equipment room or area shall consist of an area covered by an impermeable drop cloth on the floor or horizontal working surface. The area must be of sufficient size to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area. Surfaces of the equipment room shall be wet wiped two times after each shift. Materials used for wet wiping shall be disposed of as asbestos contaminated waste.

1.16.5 Decontamination Requirements for Class IV Work (Not used in this project)

1.16.6 Decontamination Area Entry Procedures

The Contractor shall ensure that employees entering the decontamination area through the clean room or clean area:

a. Remove street clothing in the clean room or clean area and deposit it in lockers.

b. Put on protective clothing and respiratory protection before leaving the clean room or clean area.

c. Pass through the equipment room to enter the regulated area.

1.16.7 Decontamination Area Exit Procedures

The Contractor shall ensure that the following procedures are followed:

a. Before leaving the regulated area, respirators shall be worn while employees remove all gross contamination and debris from their work clothing using a HEPA vacuum.

b. Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers for disposal and/or laundering.

c. Employees shall not remove their respirators in the equipment room.

d. Employees shall shower prior to entering the clean room. If a shower has not been located between the equipment room and the clean room or the work is performed outdoors, the Contractor shall ensure that employees engaged in : a) Remove asbestos contamination from their work suits in the equipment room or decontamination area using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or b) Remove their contaminated work suits in the equipment room, without cleaning worksuits, and proceed to a shower that is not adjacent to the work area.

e. After showering, employees shall enter the clean room before changing into street clothes.

1.16.8 Lunch Areas

The Contractor shall provide lunch areas where the airborne concentrations of asbestos are below 0.01 f/cc.

1.16.9 Smoking

Smoking is discouraged but, if allowed by the Contractor, shall only be permitted in designated areas approved by the Contracting Officer.

1.17 REGULATED AREAS

All asbestos abatement work shall be conducted within regulated areas. The regulated area shall be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they shall demarcate the regulated area. Access to regulated areas shall be limited to authorized persons. The Contractor shall control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

1.18 WARNING SIGNS AND TAPE

Warning signs and tape printed bilingually, in English and Spanish. Pictographs and graphics shall be provided at the regulated boundaries and entrances to regulated areas. The Contractor shall ensure that all personnel working in areas contiguous to regulated areas comprehend the warning signs. Signs shall be so located to allow personnel to read the signs and take the necessary protective steps required before entering the area. Warning signs shall be in vertical format conforming to \-29 CFR 1910-\ and \-29 CFR 1926-\ Section .1101, minimum \^500 by 350 mm^\ \~20 by 14 inches~\ and displaying the following legend in the lower panel:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING

ARE REQUIRED IN THIS AREA

Spacing between lines shall be at least equal to the height of the upper of any two lines. Warning tape shall be provided. Decontamination unit signage shall be posted.

1.19 WARNING LABELS

Warning labels shall be affixed to all asbestos disposal containers used to contain asbestos materials, scrap, waste debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to requirements are acceptable. Warning labels shall conform to \-29 CFR 1926-\ Section .1101 and shall be of sufficient size to be clearly legible displaying the following legend:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

1.20 *LOCAL EXHAUST VENTILATION*

Local exhaust ventilation units shall conform to \-ANSI Z9.2-\ and \-29 CFR 1926-\ Section .1101. Filters on local exhaust system equipment shall conform to \-ANSI Z9.2-\ and \-UL 586-\. Filter shall be UL labeled.

1.21 TOOLS

Vacuums shall be leak proof to the filter, equipped with HEPA filters, of sufficient capacity and necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain the ACM waste material. Power tools shall not be used to remove ACM unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system or has otherwise been approved for use by the Contracting Officer. All residual asbestos shall be removed from reusable tools prior to storage and reuse. Reusable tools shall be thoroughly decontaminated prior to being removed from regulated areas.

1.22 RENTAL EQUIPMENT

If rental equipment is to be used, written notification shall be provided to the rental agency, concerning the intended use of the equipment, the possibility of asbestos contamination of the equipment and the steps that will be taken to decontaminate such equipment. A written acceptance of the terms of the Contractor's notification shall be obtained from the rental agency.

1.23 AIR MONITORING EQUIPMENT

The Contractor's Designated CIH shall select and approve air monitoring equipment to be used to collect samples. The equipment shall include, but not be limited to:

a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute when equipped with a sampling train of tubing and filter cassette.

b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute when equipped with a sampling train of tubing and filter cassette, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps shall also be equipped with an automatic flow control unit which shall maintain a constant flow even as filter resistance increases due to accumulation of fiber and debris on the filter surface.

c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands, to be used with low flow pumps in accordance with \-29 CFR 1926-\ Section .1101 for personal air sampling.

d. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands, to be used with high flow pumps when conducting environmental area sampling using \-NIOSH Pub No. 84-100-\ Methods 7400 and 7402.

e. Appropriate plastic tubing to connect the air sampling pump to the selected filter cassette.

f. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of \^minus 20 to plus 60 degrees C^\ \~minus 4 to plus 140 degrees F~\ and traceable to a NIST primary standard.

1.24 EXPENDABLE SUPPLIES

1.24.1 Disposal Containers

Leak-tight disposal containers shall be provided for ACM wastes as required by \-29 CFR 1926-\ Section .1101. Leak-tight means that solids, liquids or dust cannot escape or spill out.

1.24.2 Leak-tight Wrapping

Two layers of \^0.15 mm^\ \~6 mil~\ minimum thick polyethylene sheet stock shall be used for the containment of removed asbestos-containing components or materials such as reactor vessels, large tanks, boilers, insulated pipe segments and other materials too large to be placed in disposal bags. Upon placement of the ACM component or material, each layer shall be individually leak-tight sealed with duct tape.

1.24.3 Sheet Plastic

Sheet plastic shall be polyethylene of \^0.15 mm^\ \~6 mil~\ minimum thickness and shall be provided in the largest sheet size necessary to minimize seams.

1.24.4 Viewing Inspection Window

Where feasible, a minimum of 1 clear, \^3 mm^\ \~1/8 inch~\ thick, acrylic sheet, \^450 by 610 mm^\ \~18 by 24 inches~\, shall be installed as a viewing inspection window at eye level on a wall in each containment enclosure. All such windows shall be sealed leak-tight with industrial grade duct tape.

1.24.5 Wetting Agents

Removal encapsulant (a penetrating encapsulant) shall be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant shall be capable of wetting the ACM and retarding fiber release during disturbance of the ACM equal to or greater than provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS.

1.24.6 Strippable Coating

The Contractor shall specify if this is required in the Contractor’s Asbestos Hazard Abatement plan. If used, it shall be removed cleanly by stripping at the completion of work. This work shall only be done in well ventilated areas.

1.25 MISCELLANEOUS ITEMS

A sufficient quantity of other items shall be provided including, but not limited to, scrapers, brushes, brooms, staple guns, tarpaulins, shovels, rubber squeegees, dust pans, other tools, scaffolding, staging, enclosed chutes, wooden ladders, lumber necessary for the construction of containments, UL approved temporary electrical equipment, material and cords, ground fault circuit interrupters, water hoses of sufficient length, fire extinguishers, first aid kits, portable toilets, logbooks, log forms, markers with indelible ink, spray paint in bright color to mark areas, project boundary fencing, etc.

PART 2 PRODUCTS

2.1 *ENCAPSULANTS*\

Encapsulants shall conform to USEPA requirements, shall contain no toxic or hazardous substances and no solvent and shall meet the following requirements:

\^ ALL ENCAPSULANTS

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	\-ASTM E 84-\

Combustion Toxicity Zero Mortality	Univ. of Pittsburgh Protocol
Life Expectancy, 20 yrs Accelerated Aging Test	\-ASTM C 732-\
Permeability - Minimum 0.4 Perms	\-ASTM E 96-\

Additional Requirements for Bridging Encapsulant

Requirement	Test Standard
Cohesion/Adhesion Test, 730 N/m	\-ASTM E 736-\
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	\-ASTM E 119-\
Impact Resistance, Min. 4.7 N-m (Gardner Impact Test)	\-ASTM D 2794-\
Flexibility, no rupture or cracking (Mandrel Bend Test)	\-ASTM D 522-\

Additional Requirement for Penetrating Encapsulant

Requirement	Test Standard
Cohesion/Adhesion Test, 730 N/m	\-ASTM E 736-\
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	\-ASTM E 119-\
Impact Resistance, Min. 4.7 N-m (Gardner Impact Test)	\-ASTM D 2794-\
Flexibility, no rupture or cracking (Mandrel Bend Test)	\-ASTM D 522-\

Additional Requirement for Lockdown Encapsulant

Requirement	Test Standard
Fire Resistance, Negligible affect on fire resistance rating over 3 hour test (Tested with fireproofing over encapsulant applied directly to steel member)	\-ASTM E 119-\
Bond Strength, 1.5 kN/m (Tests compatibility with cementitious and fibrous fireproofing)^\	\-ASTM E 736-\

2.2 MISCELLANEOUS MATERIALS

2.2.1 Glovebag

Glovebags shall be provided as described in \-29 CFR 1926-\ Section .1101. The glovebag assembly shall be \^0.15 mm^\ \~6 mil~\ thick plastic, prefabricated and seamless at the bottom with preprinted OSHA warning label.

2.2.2 Duct Tape

Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container shall be provided.

2.2.3 Disposal Bags

Leak-tight bags, \^0.15 mm^\ \~6 mil~\ thick, shall be provided for placement of asbestos generated waste.

2.2.4 Fiberboard Drums

Fiberboard drums, if used, shall be waxed coated 55-gallon capacity with metal ring at the top for lifting.

2.2.5 Cardboard Boxes

Heavy-duty corrugated cardboard boxes coated with plastic or wax to retard deterioration from moisture shall be provided. Boxes shall fit into selected ACM disposal bags. Filled boxes shall be sealed leak-tight with duct tape.

2.2.6 Polyethylene Sheet

2.2.6.1 General

Film shall be clear and conform to \-ASTM D 4397-\.

2.2.6.2 Flame Resistant

Where a potential for fire exists, flame-resistant sheets shall be provided. Film shall be frosted and shall conform to the requirements of \-NFPA 701-\.

2.2.6.3 Reinforced

Reinforced sheets shall be provided where high skin strength is required such as where it constitutes the only barrier between the regulated area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between two layers of polyethylene film. Film shall meet flame resistant standards of \-NFPA 701-\.

2.2.7 Amended Water

Amended water shall meet the requirements of \-ASTM D 1331-\.

2.2.8 Mastic Removing Solvent

Mastic removing solvent shall be nonflammable and shall not contain methylene chloride, glycol ether, or halogenated hydrocarbons. Solvents used onsite shall have a flash point greater than \^60 degrees C.^\ \~140 degrees F.~\

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall use the engineering controls and work practices required in \-29 CFR 1926-\ Section .1101(g) in all operations regardless of the levels of exposure. Personnel shall wear and utilize protective clothing and equipment as specified. Eating, smoking, drinking, chewing or applying cosmetics shall not be permitted in the regulated area. All hot work (burning, cutting, welding, etc.) shall be conducted under strictly controlled conditions in conformance with \-29 CFR 1926-\ Section .352, Fire Prevention and in compliance with Activity Hazard Analyses Appendix (see paragraph 1.7.2). Personnel of other trades, not engaged in asbestos abatement activities, shall not be exposed at any time to airborne concentrations of asbestos unless all the administrative and personal protective provisions of the Contractor's Accident Prevention Plan are complied with. Power to the regulated area shall be locked-out and tagged in accordance with \-29 CFR 1910-\ and temporary electrical service with ground fault circuit interrupters shall be provided as needed. Temporary electrical service shall be disconnected when necessary for wet removal. The Contractor shall stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc or the pre-abatement concentration, whichever is greater, outside the regulated area, or (2) equals or exceeds 1.0 f/cc inside the regulated area. The Contractor shall correct the condition to the satisfaction of the Contracting Officer, including visual inspection and air sampling, at no additional expense to the government. Work will resume only upon notification by the Contracting Officer. Corrective actions shall be documented.

3.2 PROTECTION OF ADJACENT WORK OR AREAS TO REMAIN

Asbestos abatement shall be performed without damage to or contamination of adjacent work or area. Where such work or area is damaged or contaminated, as verified by the Contracting Officer using visual inspection or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Government as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, work shall stop in all effected areas immediately and the spill shall be cleaned. When satisfactory visual inspection and air sampling analysis results are obtained and have been evaluated by the Contractor's Designated IH and the Contracting Officer, work may proceed.

3.3 OBJECTS

The Contractor shall coordinate with the Contracting Officer to remove objects, furniture and equipment.

3.4 BUILDING VENTILATION SYSTEM AND CRITICAL BARRIERS (applicable when ACM abatement is needed)

Building ventilating systems supplying air into or returning air out of an regulated area shall be shut down and isolated by lockable switch or other positive means in accordance with \-29 CFR 1910-\ Section .147. The components of the ventilation system passing through a regulated area shall be completely isolated by airtight seals to prevent the spread of contamination throughout the system. Air-tight critical barriers shall be installed on all building ventilating openings located inside the regulated area that supply or return air from the building ventilation system or

serve to exhaust air from the building. The critical barriers shall consist of air-tight rigid covers for building ventilation supply and exhaust grills where the ventilation system is required to remain in service during abatement with at least 2 layers of polyethylene sheet. Edges to wall, ceiling and floor surfaces shall be sealed with industrial grade duct tape.

3.5 PRECLEANING (applicable when ACM abatement is needed)

If the Contractor identify an area to be cleaned prior to establishment of containment, they shall be HEPA vacuum or adequately wet wiped.

3.6 METHODS OF COMPLIANCE (applicable when ACM abatement is needed)

3.6.1 Mandated Practices

The Contractor shall employ proper handling procedures in accordance with \-29 CFR 1926-\ and \-40 CFR 61-\ Subpart M, and the specification requirements herein. The specific abatement techniques and items identified shall be detailed in the Contractor's Asbestos Hazard Abatement Plan including, but not limited to, details of construction materials, equipment, and handling procedures. The Contractor shall use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

a. Vacuum cleaners equipped with HEPA filters to collect debris and dust containing ACM.

b. Wet methods or wetting agents to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup; except where it can be demonstrated that the use of wet methods is unfeasible due to, for example, the creation of electrical hazards, equipment malfunction, and in roofing.

c. Prompt clean-up and disposal in leak-tight containers of wastes and debris contaminated with asbestos.

d. Inspection and repair of polyethylene in work and high traffic areas.

e. Cleaning of equipment and surfaces of containers filled with ACM prior to removing them from the equipment room or area.

3.6.2 Control Methods

The Contractor shall use the following control methods to comply with the PELs:

a. Local exhaust ventilation equipped with HEPA filter dust collection systems;

b. Enclosure or isolation of processes producing asbestos dust;

c. Ventilation of the regulated area to move contaminated air away from the breathing zone of employees and toward a filtration or collection device equipped with a HEPA filter;

d. Use of other work practices and engineering controls;

e. Where the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the PELs, the Contractor shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with paragraph, RESPIRATORY PROTECTION PROGRAM.

3.6.3 Unacceptable Practices

The following work practices and engineering controls shall not be used for work related to asbestos or for work which disturbs ACM, regardless of measured levels of asbestos exposure or the results of initial exposure assessments:

a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

b. Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

c. Dry sweeping, shoveling, or other dry clean-up of dust and debris containing ACM.

d. Employee rotation as a means of reducing employee exposure to asbestos.

3.6.4 Class II Work (applicable when ACM abatement is needed)

In addition to the requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

a. A Competent Person shall supervise the work.

b. For indoor work, critical barriers shall be placed over all openings to the regulated area.

c. Impermeable dropcloths shall be placed on surfaces beneath all removal activity.

3.6.5 Specific Control Methods for Class II Work (applicable when ACM abatement is needed)

In addition to requirements of paragraph Class II Work, Class II work shall be performed using the following methods:

3.6.5.1 Vinyl and Asphalt Flooring Materials (if applicable to ACM abatement)

ACM vinyl flooring materials and mastic shall remain in-place and demolish with the structure. Demolition work shall be perform in accordance with the accepted Contractor’s Asbestos Hazard Abatement Plan to minimize

release of asbestos fiber during demolition (see paragraph SAFETY HEALTH PROGRAM AND PLANS).

3.6.5.2 Roofing Material (if applicable to ACM abatement)

ACM Roofing materials and penetration mastic shall remain in-place and demolish with the structures. Demolition work shall be perform in accordance with the accepted Contractor’s Asbestos Hazard Abatement Plan to minimize release of asbestos fiber (see paragraph SAFETY HEALTH PROGRAM AND PLANS).

3.6.6 Cleaning After Asbestos Removal (applicable when ACM abatement is needed)

After completion of all asbestos removal work, surfaces from which ACM has been removed shall be wet wiped or sponged clean, or cleaned by some equivalent method to remove all visible residue. Run-off water shall be collected and filtered through a dual filtration system. A first filter shall be provided to remove fibers 20 micrometers and larger, and a final filter provided that removes all fibers 5 micrometers and larger. After the gross amounts of asbestos have been removed from every surface, all remaining visible accumulations of asbestos on floors shall be collected using plastic shovels, rubber squeegees, rubber dustpans, and HEPA vacuum cleaners as appropriate to maintain the integrity of the regulated area. When all TSI and surfacing material has been removed, workmen shall use HEPA vacuum cleaners to vacuum every surface. Particular attention shall be paid to those surfaces or locations which could harbor accumulations or residual asbestos dust.

3.6.7 Abatement of Asbestos Contaminated Soil (applicable when ACM debris is spilled during ACM abatement)

Soil shall be removed to a minimum depth of \^50 mm.^\ \~2 inches.~\, if it is contaminated by asbestos waste during execution of this project. Soil shall be thoroughly dampened with amended water and then removed by manual shoveling into labeled containers. The workers shall be closely monitored for heat exhaustion. The minimum ventilation shall be 8 air changes per hour through a local exhaust HEPA system.

3.7 FINAL CLEANING AND VISUAL INSPECTION (applicable when ACM abatement is needed)

Upon completion of abatement, the regulated area shall be cleaned by collecting, packing, and storing all gross contamination. A final cleaning shall be preformed using HEPA vacuum and wet cleaning of all exposed surfaces and objects in the regulated area. Upon completion of the cleaning, the Contractor shall conduct a visual pre-inspection of the cleaned area in preparation for a final inspection before final air clearance monitoring and recleaning, as necessary. Upon completion of the final cleaning, the Contractor and the Contracting Officer shall conduct a final visual inspection of the cleaned regulated area in accordance with \-ASTM E 1368-\ and document the results on the Final Cleaning and Visual Inspection and Contracting Officer Acceptance or Rejection, appended herein. If the Contracting Officer rejects the clean regulated area as not meeting final cleaning requirements, the Contractor shall reclean as necessary and have a follow-on inspection conducted with the Contracting

Officer. Recleaning and follow-up reinspection shall be at the Contractor's expense.

3.8 LOCKDOWN (applicable when ACM abatement is needed)

Prior to removal of plastic barriers and after clean-up of gross contamination and final visual inspection, a post removal (lockdown) encapsulant shall then be spray applied to ceiling, walls, floors, and other surfaces in the regulated area.

3.9 *AIR MONITORING*\

3.9.1 General Requirements

Air monitoring and analysis of airborne concentration of asbestos fibers shall be performed in accordance with \-29 CFR 1926-\ Section .1101, the Contractor's air monitoring plan, and as specified. Personal exposure air monitoring (collected at the breathing zone) that is representative of the exposure of each employee who is assigned to work within a regulated area shall be performed by the Contractor's Designated IH. The Contractor shall be responsible for fees associated with exposure assessment, air monitoring and final clearance. Breathing zone samples shall be taken for at least 25 percent of the workers in each shift, or a minimum of two, whichever is greater. Air monitoring results at the 95 percent confidence level shall be calculated as shown in Table 2 at the end of this section. The Contractor shall provide an independent testing laboratory with qualified analysts and appropriate equipment to conduct sample analyses of air samples using the methods prescribed in \-29 CFR 1926-\ Section .1101 to include \-NIOSH Pub No. 84-100-\ Method 7400. Preabatement and abatement environmental air monitoring shall be performed by the Contractor's IHT. Final clearance environmental air monitoring, shall be performed by the Contractor's IHT. Environmental and final clearance air monitoring shall be performed using \-NIOSH Pub No. 84-100-\ Method 7400 (PCM) with optional confirmation of results by \-NIOSH Pub No. 84-100-\ Method 7402 (TEM). For environmental and final clearance, air monitoring shall be conducted at a sufficient velocity and duration to establish the limit of detection of the method used at 0.005 f/cc. Confirmation of asbestos fiber concentrations (asbestos f/cc) from environmental and final clearance samples collected and analyzed by \-NIOSH Pub No. 84-100-\ Method 7400 (total f/cc) may be conducted using TEM in accordance with \-NIOSH Pub No. 84-100-\ Method 7402. When such confirmation is conducted, it shall be from the same sample filter used for the \-NIOSH Pub No. 84-100-\ Method 7400 PCM analysis. For all Contractor required environmental or final clearance air monitoring, confirmation of asbestos fiber concentrations, using \-NIOSH Pub No. 84-100-\ Method 7402, shall be at the Contractor's expense. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. Results of breathing zone samples shall be posted at the job site and made available to the Contracting Officer. The Contractor shall maintain a fiber concentration inside a regulated area equal to or less than 0.1 f/cc expressed as an 8 hour, time-weighted average (TWA) during the conduct of the asbestos abatement. If fiber concentration rises above 0.1 f/cc, work procedures shall be investigated with the Contracting Officer to determine the cause. At the discretion of the Contracting Officer, fiber concentration may exceed 0.1 f/cc but shall not exceed 1.0 f/cc expressed as an 8-hour TWA. The Contractor's workers shall not be exposed to an airborne fiber concentration in excess of 1.0

f/cc, as averaged over a sampling period of 30 minutes. Should either an environmental concentration of 1.0 f/cc expressed as an 8-hour TWA or a personal excursion concentration of 1.0 f/cc expressed as a 30-minute sample occur inside a regulated work area, the Contractor shall stop work immediately, notify the Contracting Officer, and implement additional engineering controls and work practice controls to reduce airborne fiber levels below prescribed limits in the work area. Work shall not restart until authorized by the Contracting Officer.

3.9.2 Preabatement and Environmental Air Monitoring (applicabel if ACM abatement is needed)

Preabatement environmental air monitoring shall be established prior to the masking and sealing operations for each regulated area to determine background concentrations before abatement work begins. As a minimum, preabatement air samples shall be collected using \-NIOSH Pub No. 84-100-\ Method 7400, PCM at these locations: outside the building; inside the building, but outside the regulated area perimeter; and inside each regulated work area. One sample shall be collected for every \^185 square meters^\ \~2000 square feet~\ of floor space. At least two samples shall be collected outside the building: at the exhaust of each HEPA unit; and downwind from the abatement site. The PCM samples shall be analyzed within 24 hours; and if any result in fiber concentration greater than 0.01 f/cc, asbestos fiber concentration shall be confirmed using \-NIOSH Pub No. 84-100-\ Method 7402 (TEM).

3.9.3 Environmental Air Monitoring During ACM Abatement (if applicable or Demolition of Structures

Until an exposure assessment is provided to the Contracting Officer demonstrating that the product or material containing asbestos minerals, or the abatement involving such product or material, cannot release airborne asbestos fibers in concentrations exceeding 0.01 f/cc as a TWA under those work conditions having the greatest potential for releasing asbestos, environmental air monitoring shall be conducted at locations and frequencies that will accurately characterize any evolving airborne asbestos fiber concentrations. The monitoring shall be at least once per shift at locations including, but not limited to, close to the work inside each regulated area; preabatement sampling locations; outside entrances to regulated areas; close to glovebag operations; representative locations outside of the perimeter of regulated areas; inside each clean room; and at the exhaust discharge point of each local exhaust system ducted to the outside of a containment (if used). If the sampling outside regulated area shows airborne fiber levels have exceeded background or 0.01 f/cc, whichever is greater, all work shall be stopped immediately, and the Contracting Officer notified. The condition causing the increase shall be corrected. Work shall not restart until authorized by the Contracting Officer.

3.9.4 Final Clearance Air Monitoring

Final clearance air monitoring is not required in this project.

3.9.5 Air-Monitoring Results and Documentation

Air sample fiber counting shall be completed and results provided within 24 hours (breathing zone samples), and 24 hours (environmental monitoring) after completion of a sampling period. The Contracting Officer shall be notified immediately of any airborne levels of asbestos fibers in excess of established requirements. Written sampling results shall be provided within 5 working days of the date of collection. The written results shall be signed by testing laboratory analyst, testing laboratory principal and the Contractor's designated CIH and IHT. The air sampling results shall be documented on a Contractor's daily air monitoring log. The daily air monitoring log shall contain the following information for each sample:

a. Sampling and analytical method used;

b. Date sample collected;

c. Sample number;

d. Sample type: BZ = Breathing Zone (Personal), P = Preabatement, E = Environmental, C = Abatement Clearance;

e. Location/activity/name where sample collected;

f. Sampling pump manufacturer, model and serial number, beginning flow rate, end flow rate, average flow rate (L/min);

g. Calibration date, time, method, location, name of calibrator, signature.

h. Sample period (start time, stop time, elapsed time (minutes);

I. Total air volume sampled (liters);

j. Sample results (f/cc);

k. Laboratory name, location, analytical method, analyst, confidence level. In addition, the printed name and a signature and date block for the IHT who conducted the sampling and for the CIH who reviewed the daily air monitoring log verifying the accuracy of the information.

3.10 CLEARANCE CERTIFICATION

When asbestos abatement is complete and all ACM waste is removed from the regulated areas, and final clean-up is completed, the Contracting Officer will certify the areas as safe before the warning signs and boundary warning tape can be removed. After final clean-up and acceptable airborne concentrations are attained, but before the HEPA unit is turned off and the containment removed, the Contractor shall remove all pre-filters on the building HVAC system and provide new pre-filters. The Contractor shall dispose of such filters as asbestos contaminated materials. HVAC mechanical, and electrical systems shall be re-established in proper working order. The Contractor and the Contracting Officer will visually inspect all surfaces within the regulated work area for residual materials or accumulated debris. The Contractor shall reclean all areas showing dust or residual materials. The Contracting Officer will certify in writing that the area is safe before unrestricted entry is permitted. The Government will have the option to perform monitoring to certify the areas are safe before entry is permitted.

3.11 CLEANUP AND DISPOSAL

3.11.1 Title to ACM Materials

ACM material resulting from abatement work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified and in accordance with applicable federal, state and local regulations.

3.11.2 Collection and Disposal of Asbestos

All ACM waste including contaminated wastewater filters, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing, shall be collected and placed in leak-tight containers such as double plastic bags ; sealed double wrapped polyethylene sheet; sealed fiberboard boxes; or other approved containers. Waste within the containers shall be wetted in case the container is breeched. Asbestos-containing waste shall be disposed of at the Fort Hood Sanitary Landfill. For temporary storage, sealed impermeable containers shall be stored in an asbestos waste load-out unit or in a storage/transportation conveyance (i.e., dumpster, roll-off waste boxes, etc.) in a manner acceptable to and in an area assigned by the Contracting Officer. Procedure for hauling and disposal shall comply with \-40 CFR 61-\ Subpart M, state, regional, and local standards.

3.11.3 Scale Weight Measurement

If new vehicle or transporter is used, the Contractor shall comply with scales weight system at the Fort Hood Sanitary landfill. Scales used for measurement shall be public scales. Weighing shall be at a point nearest the work at which a public scale is available. Scales should be standard truck scales of the beam type and shall be equipped with the type registering beam and an "over and under" indicator and be capable of accommodating the entire vehicle. Scales shall be tested, approved and sealed by an inspector of the State of Texas. Scales shall be calibrated and resealed as often as necessary and at least once every three months to insure continuous accuracy. Vehicles used for hauling ACM shall be weighed empty daily at such time as directed and each shall bear a plainly legible identification mark.

3.11.4 Weigh Bill and Delivery Tickets

Copies of weigh bills and delivery tickets shall be submitted to the Contracting Officer during the progress of the work. The Contractor shall furnish the Contracting Officer scale tickets for each load of ACM weighed and certified. These tickets shall include tare weight, identification mark for each vehicle weighed, date, time and location of loading and unloading. Tickets shall be furnished at the point and time individual trucks arrive at the worksite. A master log of all vehicle loading shall be furnished for each day of loading operations. Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified weigh bills and/or certified tickets and manifests of all ACM actually disposed by the Contractor for this contract.

3.11.5 Asbestos Waste Shipment Record

The Contractor shall complete and provide all project documents (see paragraph SUBMITTALS, Closure Report to the Contracting Officer at project completion before final payment. The Contracting Officer shall have the final completed copies of the Waste Shipment Record for all shipments of waste material as specified in \-40 CFR 61-\ Subpart M and other required state waste manifest shipment records within 3 days of delivery to the landfill. Each Waste Shipment Record shall be signed and dated by the generator, the waste transporter and disposal facility operator.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

TABLE 1

INDIVIDUAL WORK TASK DATA ELEMENT

1. WORK TASK DESIGNATION NUMBER:

2. LOCATION OF WORK TASK:

3. BRIEF DESCRIPTION OF MATERIAL TO BE ABATED:

   Type of Asbestos:
   % asbestos content:

4. ABATEMENT TECHNIQUE TO BE USED:

5. OSHA ASBESTOS CLASS DESIGNATION FOR WORK TASK:

6. EPA NESHAP FRIABILITY DESIGNATION FOR WORK TASK:

7. FORM ____ and CONDITION OF ACM: ____

8. QUANTITY:

NOTES:

(1) Numeric sequence of individual work tasks (1,2,3,4, etc.) for each regulated area. Each category of EPA friability/OSHA class has a separate task.
(2) Specific location of work (building, floor, area, e.g. Building 1421, 2nd Floor, Rm 201)
(3) A description of material to be abated (example: horizontal pipe, cement wall panels, tile, stucco, etc.) type of asbestos (chrysotile, amosite, crocidolite, etc.); and % asbestos content.
(4) Technique to be used: Removal = REM; Encapsulation = ENCAP; Encasement = ENCAS; Enclosure = ENCL; Repair = REP.
(5) Class designation: Class I or II(OSHA designation).
(6) Friability of materials: Check the applicable EPA NESHAP friability designation.
(7) Form: Interior or Exterior Architectural = IA or EA; Mechanical/Electrical = ME. Condition: Good = G; Fair = F; Poor = P.
(8) Quantity of ACM for each work task in linear feet or square feet.

TABLE 2

FORMULA FOR CALCULATION OF THE 95 PERCENT CONFIDENCE LEVEL
(Reference: NIOSH 7400

Fibers/cc(01.95 percent CL) = X + [(X)* (1.645)* (CV)]

Where: X = ((E)(AC))/((V)(1000))

E = ((F/Nf) - (B/Nb))/Af

CV = The precision value; 0.45 shall be used unless the analytical laboratory provides the Contracting Officer with documentation (Round Robin Program participation and results) that the laboratory's precision is better.

AC = Effective collection area of the filter in square millimeters

V = Air volume sampled in liters

E = Fiber density on the filter in fibers per square millimeter

F/Nf = Total fiber count per graticule field

B/Nb = Mean field blank count per graticule field

Af = Graticule field area in square millimeters

TWA = C1/T1 + C2/T2 = Cn/Tn

Where: C = Concentration of contaminant

T = Time sampled.

TABLE 3

NI0SH METHOD 7400

PCM ENVIRONMENTAL AIR SAMPLING PROTOCOL (NON-PERSONAL)

Sample Location	Minimum No. of Samples	Filter Pore Size (Note 1)	Min. Vol. (Note 2) (Liters)	Sampling Rate (liters/min)
Inside Abatement Area	0.5/140 Square Meters	0.45 microns (Notes 3 & 4)	1500	2-10
Each Room in 1 Abatement Area Less than 140 Square meters		0.45 microns	1500	2-10
Field Blank	2	0.45 microns	0	0
Laboratory Blank	1	0.45 microns	0	0

Notes:

1. Type of filter is Mixed Cellulose Ester.

2. Ensure detection limit for PCM analysis is established at 0.005 fibers/cc.

3. One sample should be added for each additional 140 square meters. (The corresponding I-P units are 5/1500 square feet).

4. No less than 5 samples are to be taken per abatement area, plus two field blanks.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME _____ CONTRACT NO. _____
PROJECT ADDRESS _____
CONTRACTOR FIRM NAME _____
EMPLOYEE'S NAME _____,_____,_____,_____-_____-_____
(Print) (Last) (First) (MI) Social Security Number

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH TYPES OF LUNG DISEASE AND CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NONSMOKING PUBLIC.

Your employer's contract for the above project requires that you be provided and you complete formal asbestos training specific to the type of work you will perform and project specific training; that you be supplied with proper personal protective equipment including a respirator, that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that your employer has met these obligations to you. The Contractor's Designated Industrial Hygienist will check the block(s) for the type of formal training you have completed. Review the checked blocks prior signing this certification.

FORMAL TRAINING:

____ a. For Competent Persons and Supervisors: I have completed EPA's Model Accreditation Program (MAP) training course, "Contractor/Supervisor" that meets this State's requirements.

b. For Workers:

____ (2) For OSHA Class II work (where there will be abatement of more than one type of Class II materials i.e. roofing, siding, floor tile, etc.): I have completed EPA's MAP training course, "Worker" that meets this State's requirements.

(3) For OSHA Class II work (there will only be abatement of one type of Class II material):

____ (a) I have completed an 8-hour training class on the elements of \-29 CFR 1926-\ Section .1101(k)(9)(viii) in addition to the specific work practices and engineering controls of \-29 CFR 1926-\ Section .1101(g) and hands-on training.

____ (b) I have completed EPA's MAP training course, "Worker" that meets this State's requirements.

____

____ c. Workers, Supervisors and the Designated Competent Person: I have completed annual refresher training as required by EPA's MAP that meets this State's requirements.

PROJECT SPECIFIC TRAINING:
____ I have been provided and have completed the project specific training required by this Contract. My employer's Designated Industrial Hygienist and Designated Competent Person conducted the training.

RESPIRATORY PROTECTION:
____ I have been trained in accordance with the criteria in the Contractor's Respiratory Protection program. I have been trained in the dangers of handling and breathing asbestos dust and in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair and contact lens use policy of my employer.

RESPIRATOR FIT-TEST TRAINING:
____ I have been trained in the proper selection, fit, use, care, cleaning, maintenance, and storage of the respirator(s) that I will wear. I have been fit-tested in accordance with the criteria in the Contractor's Respiratory Program and have received a satisfactory fit. I have been assigned my individual respirator. I have been taught how to properly perform positive and negative pressure fit-check upon donning negative pressure respirators each time.

MEDICAL EXAMINATION:
____ I have had a medical examination within the last twelve months which was paid for by my employer. The examination included: health history, pulmonary function tests, and may have included an evaluation of a chest x-ray. A physician made a determination regarding my physical capacity to perform work tasks on the project while wearing personal protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's Industrial Hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

___ were no limitations to performing the required work tasks.
___ were identified physical limitations to performing the required work tasks.

Date of the medical examination _____

Employee Signature _____ date _____
Contractor's Industrial Hygienist Signature _____ date _____

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

CERTIFICATION OF FINAL CLEANING AND VISUAL INSPECTION

Individual abatement task identified in Table 1

In accordance with the cleaning and decontamination procedures specified in the Contractor's Asbestos Hazard Abatement Plan and this contract, the Contractor hereby certifies that he/she has thoroughly visually inspected all surfaces of the decontaminated regulated work area per ASTM E1368, Standard Practice for Visual Inspection of Asbestos Abatement Projects, and has found no dust, debris, or asbestos-containing material residue.

By: (Contractor's signature)_____

Print Name and Title_____

Date_____

By: Contractor's onsite supervisor

signature_____

Print Name and Title_____

Date_____

By: Contractor's CIH

signature_____

Print Name and Title_____

Date_____

By: Contractor's IHT

signature_____

Print Name and Title_____

Date_____

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

CONTRACTING OFFICER ACCEPTANCE OR REJECTION

The Contracting Officer hereby determines that the Contractor has performed final cleaning and visual inspection of all surfaces of the decontaminated regulated work area. And by quality assurance inspection, finds the Contractor's final cleaning to be:

_____ ACCEPTABLE

_____ UNACCEPTABLE, CONTRACTOR INSTRUCTED TO RECLEAN THE REGULATED WORK AREA

By: Contracting Officer's Representative

Signature_____

Print Name and Title_____

Date_____

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02091

LEAD-CONTAINING PAINT (LCP) WORKER PROTECTION PLAN

PART
1 - GENERAL

1.1 REFERENCES

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

CODE OF FEDERAL REGULATIONS (CFR)

\-29 CFR 1910-\	Occupational Safety and Health Standards
\-29 CFR 1926-\	Safety and Health Regulations for Construction

ENGINEERING MANUALS (EM)

\-EM 385-1-1-\	(1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 SUBMITTALS

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

SD-01 Data\

Equipment List\; *GA*\.

A list of equipment and other items to be used in the work, including brand names, model, capacity, performance characteristics, quantities and other pertinent information.

SD-08 Statements\

Accident Prevention Plan(APP)\; *GA*\.

The Contractor shall prepare and submit APP as described in paragraph 1.10, ACCIDENTAL PREVENTION PLAN this section.

Worker Protection Plan\; *GA*\.

The Contractor shall prepare a detailed Worker Protection Plan that identifies the work procedures, health, and safety measures to be used while performing work which may penetrate or disturb lead-containing paint. The plan shall address methods to be used to minimize airborne lead dust hazards to workers. The plan shall at least include the following key elements:

a. Methods of disturbing LCP.

b. Means for notifying proposed work schedules to occupants of the adjacent work areas.

c. Worker protection training requirements as required in 1926.62.

d. Methods of minimizing exposure to lead dust, (i.e. dust control and wetting agent).

e. Personnel protective equipment, respiratory protection program and controls.

f. Engineering controls and safety measures.

g. Worker exposure assessment procedures, i.e. personal air monitoring, name of laboratory, analyst, and air monitoring technician.

h. Housekeeping.

I. Hygiene facilities and practice.

j. Medical surveillance, including medical removal protection.

k. Sampling, testing and analytical methods to include personal air sampling requirements of \-29 CFR 1926-\ Section .62, procedures, frequency and locations.

SD-09 Reports\

Sampling Result and Final Disposition Report\; *GA*\.

A daily log of the personal air sampling test results shall be reviewed by the Competent Person and submitted, in written form, no more than 48 hours after completion of the sampling cycle. The log shall list each sample result, sampling time and date, sample type, identification of personnel monitored, flow rate and duration, air volume sampled, yield of lead, cassette size, analytical method, name of independent laboratory, analyst's and air monitoring technician, and interpretation of results. Results shall be reported in micrograms of lead per cubic meter of air. Documentation of results that exceed specified limits (personal air samples that exceed 30 micrograms per cubic meter) or as required by Federal, state or local requirements shall be highlighted in the log in such a manner to make them easily distinguishable from monitoring results that do not exceed specified or regulatory limits.

A Final Disposition Report of work performed in this section shall be provided in 5 working days after project completion.

SD-13 Certificates\

Quality Assurance\; *GA*\.

Certificates shall meet the requirements of paragraph QUALITY ASSURANCE. The statements shall be signed and dated by a certifying officer after the award of this contract and contain the following:

a. Contractor's name and address.

b. Project name and location.

c. The specified requirements that are being certified.

1.3 *QUALITY ASSURANCE*\

1.3.1 Qualifications

a. Contractor: Certification that the Contractor has prior experience on projects similar in nature and extent to ensure the capability to perform the abatement in a satisfactory manner.

b. Competent Person: Certification that the Contractor's full-time onsite Competent Person meets requirements of \-29 CFR 1926-\ Section .62 and is experienced in administration and supervision of similar projects, including work practices, protective measures for building and personnel, disposal procedures, etc. This person shall have completed a Contractor Supervisor LBP abatement course by an EPA Training Center or an equivalent certification course, and have had a minimum of 2 years on-the-job experience.

c. Testing Laboratory: The name, address, and telephone number of the independent testing laboratory selected to perform sampling and analysis for personal air samples. Documentation that the laboratory performing the analysis is an EPA National Lead Laboratory Accreditation Program (NLLAP) accredited laboratory and that it is rated proficient in the NIOSH/EPA Environmental Lead Proficiency Analytical Testing Program (ELPAT). Certification shall include accreditation for heavy metal analysis, list of experience relevant to analysis of lead in air, and a Quality Assurance and Quality Control Program. Currently, the American Association for Laboratory Accreditation (ASLA) and the American Industrial Hygiene Association (AIHA) are the EPA recognized laboratory accreditors. Documentation shall include the date of accreditation or reaccreditation.

d. Blood Lead Testing Laboratory. The name, address and telephone number of the blood lead testing laboratory; the laboratory's listing by OSHA and the U.S. Public Health Service Center for Disease Control (CDC); and documentation that the laboratory certified in the state where the work site is located.

1.3.2 Respiratory Protection Devices

Manufacturer's certification of NIOSH or the Mine Safety and Health Administration (MSHA) approval for respiratory protection devices utilized on the site.

1.3.3 Cartridges, Filters, and Vacuum Systems

Manufacturer's certification of NIOSH approval of respirator cartridges.

1.3.4 Medical Records

As required by \-29 CFR 1926-\ Section .62 and by the state and local regulations, employees who are involved in paint disturbance shall have

receive medical examinations and continued medical surveillance. Certification of such examination, including biological monitoring shall be provided by the Contractor. Records shall be retained, at Contractor expense, in accordance with \-29 CFR 1910-\ Section .20.

1.3.5 Training

Training shall meet the requirements of \-29 CFR 1926-\ Section .62, \-29 CFR 1926-\ Section .59. Training shall be provided prior to the time of job assignment. Training shall be an awareness of disturbance methods specified in the Contractor’s Worker Protection Plan. Training certification shall be provided prior to the start of work for all of the Contractors' workers, supervisors and Competent Person. Training shall be provided prior to start of work for all workers, supervisors, and Competent Person.

Project specific training shall be conducted prior to the start of paint disturbance work. Training shall address specific methods to be used and protection of workers as outlined in the Contractor’s Worker Protection Plan.

1.4 DESCRIPTION OF WORK

This section describes the procedures and equipment required to protect workers and minimize lead dust exposure during demolition of Building No. 3272 and 3273 for Base Bid of the General Instruction Building project at Fort Hood, Texas. Because the Consumer Product Safety Act of 1997 established a limit on the level of lead allowed in paints formulated for consumer use, the surfaces of the structure have low level of lead. This low level of lead in paint is called lead-containing paint in this section. Abatement is not required prior to demolition. In accordance with OSHA 29 CFR 1926.62, worker protection is required, until an exposure assessment confirms that exposure to airborne level of lead is below 30 micrograms per cubic meter (ug/m^3).

Building 3272 is a painted loading dock facility that was built in 1984. It has 378 square feet building and an open area of 1600 square feet covered by a canopy. Building 3273 is 530 square feet painted CMU latrine that was built in 1983. These structures are non-residential waste characterization is required for disposal in accordance with the Texas Natural Resource Conservation Commission (TNRCC) guidance memorandum, <u>How to Characterize and Dispose of Lead Contaminated Demolition Debris from Total Demolition of Structures which have Previously Received Applications of Lead-Based Paint</u>, dated 11 January, 1996. A composite sample of exterior and interior painted surfaces with the substrates (except metal building components) shall be obtained from each of the two structures. The composite samples shall be tested for TCLP Lead in accordance with EPA Method 1311/6010. From experience with past project, it is very likely that the TCLP Lead results will be less than 1.5 mg/l. It will be classified as Class II waste. Disposal of the structures shall be in accordance with the specification section 02080 - Worker Protection During Demolition of Structures that Contain Asbestos Containing Materials (ACM). The Contractor shall practice waste minimization to the maximum extent possible through waste segregation and recycling of metal, plastic and glass.

1.5 SITE VISIT

The Contractor shall visit and become familiar with conditions which will affect the work.

1.6 PROTECTION OF EXISTING WORK TO REMAIN

All work shall be performed without damaging or contaminating adjacent work areas. Where such areas are damaged or contaminated, the Contractor shall restore areas to the original condition, at no additional expense to the Government.

1.7 COORDINATION WITH OTHER WORK

Paint disturbing and disposal of debris shall be coordinated with existing work and/or concurrent work being performed in adjacent areas.

1.8 SAFETY AND HEALTH REGULATORY REQUIREMENTS

Work shall be performed in accordance with requirements of \-EM 385-1-1-\ and applicable regulations including, but not limited to \-29 CFR 1910-\, \-29 CFR 1926-\, especially Section .62. Matters of interpretation of the standards shall be submitted to the appropriate agency for resolution before starting work. Where these requirements vary, the most stringent shall apply.

1.9 PRECONSTRUCTION SAFETY MEETING

The Contractor and the Competent Person shall attend a preconstruction safety meeting prior to starting work. Items required to be submitted will be reviewed for completeness, and where specified, for acceptance.

1.10 ACCIDENT PREVENTION PLAN

1.10.1 Preparation and Implementation

The Accident Preparation Plan (APP) shall be prepared in accordance with \-EM 385-1-1-\, Appendix A. Where topic in Appendix A is not applicable, the APP shall justify its omission or reduced level of detail, and establish that adequate consideration was given to the topic. The APP shall cover onsite work by the Contractor or subcontractors. The Competent Person shall be responsible for development, implementation, and quality control of the content and actions required in the APP. For each anticipated work task, the APP shall establish hazards and control measures. The APP shall be easily readable and understandable by the Contractor's work force.

1.10.2 Acceptance and Modifications

The APP shall be prepared, signed and dated by the Contractors Competent Person and submitted 10 working days prior to the preconstruction safety conference. Deficiencies in the APP shall be discussed at the Preconstruction Safety Conference and the APP shall be revised to correct the deficiencies, and resubmitted for acceptance. Onsite work shall not begin until the APP has been accepted unless otherwise authorized by the Contracting Officer. One copy of the APP shall be maintained in the

Contractor's jobsite file, and a second copy shall be posted where it will be accessible to personnel on the site. As work proceeds, the APP shall be adapted to new situations and conditions. Changes to the APP shall be made with concurrence of the Competent Person and Site Superintendent, and acceptance of the Contracting Officer. Should an unforeseen hazard become evident during performance of the work, the Competent Person shall bring such hazard to the attention of the Superintendent and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, the Contractor shall take necessary action to re-establish and maintain safe working conditions; and to safeguard onsite personnel, visitors, the public, and the environment. Disregard for provisions of this specification, or the accepted APP shall be cause for stopping of work until the matter is rectified.

1.10.3 Activity Hazard Analyses

An Activity Hazard Analysis (AHA) shall be prepared prior to beginning each major phase of the work and submitted for review and acceptance. Format shall be in accordance with \-EM 385-1-1-\, figure 1-1. A major phase of work is defined as an operation involving hazards not experienced in previous operations, or where a new work crew is to perform. The analysis shall define the activities and the sequence in which they are to be performed, specific hazards anticipated, and control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the Activity Hazard Analysis has been accepted and a preparatory meeting has been conducted by the Contractor to discuss content of the AHA with everyone engaged in the activity, including the Government's onsite representative. The AHA shall be continuously reviewed and modified when appropriate to address changing conditions or operations. The accepted AHA shall be appended to and become part of the APP.

1.11 RESPIRATORY PROTECTION PROGRAM

A respiratory protection program shall be established as required by \-29 CFR 1926-\ Section .103 and .62 and in accordance with \-29 CFR 1910-\ Section .134. An approved respirator shall be furnished to each employee and visitor required to enter a LBP work control area. A fit test shall be conducted in accordance with \-29 CFR 1926-\ Section .62, Appendix D.

1.12 HAZARD COMMUNICATION PROGRAM

A Hazard Communication Program shall be implemented in accordance with \-29 CFR 1926-\ Section .59.

1.13 SAFETY AND HEALTH OVERSIGHT

The Competent Person shall be the onsite person responsible for coordination, safety, security and execution of the work. The Competent Person shall be able to identify existing and predictable lead hazards and shall have the authority to take corrective measures to eliminate them.

1.14 PREPARATORY INSPECTION MEETING

The Contractor and the Contracting Officer shall arrange and hold a preparatory inspection meeting immediately prior to beginning work. The

APP, Activity Hazard Analyses, and the Contractor's Worker Protection Plan, including containment, engineering controls, worker protection, training, and monitoring, will be reviewed for completeness (see paragraph, Submittals).

1.15 TRAINED AND COMPETENT PERSONNEL

Work shall be performed by persons, qualified and trained to perform monitoring and in subsequent cleanup of the affected environment. Workers shall comply with the appropriate Federal, state, and local regulations which mandate training requirements, work practices, and performing work under this contract.

1.16 POSTED WARNINGS AND NOTICES

A copy of regulations, warnings, and notices shall be posted at the work site in accordance with \-29 CFR 1926-\ Section .62. A copy shall be file in the project file.

1.16.1 Limited Access

Access to work control areas shall be limited to trained and properly protected workers and visitors until air monitoring results indicate the airborne lead level is below the Action Level of 30 ug/m^3 per 29 CFR 1926.62. Signs shall be posted at a distance from the work control areas that will allow personnel to read and take necessary protective actions before entering the work control area.

1.16.2 Worker Information

Right-to-know notices shall be placed in clearly visible areas of the work site in compliance with Federal, state, and local regulations.

1.16.3 Air Monitoring Results

Daily air monitoring results shall be prepared so as to be easily understood by the workers, and shall be placed in a clearly visible area of the work site.

1.16.4 Emergency Telephone Numbers

A list of telephone numbers shall be posted at the site. The list shall include numbers of the local hospital, emergency squad, police and fire departments, Government and Contractor representatives who can be reached 24 hours per day, and professional consultants directly involved in the project.

1.17 PERSONAL PROTECTIVE EQUIPMENT (PPE)

A list of PPE shall be provided in the Contractor’s Worker Protection Plan.

1.17.1 Respiratory Protection

Respirators required for worker protection during this project as approved by NIOSH for such use shall be determined by the Competent Person. Respirators shall comply with the requirements of \-29 CFR 1926-\ Section

.62 and shall be used in accordance with \-29 CFR 1926-\ Section .103 and \-29 CFR 1910-\ Section .134.

A sufficient supply of respirator cartridges shall be maintained at the work site to provide new cartridges to employees, authorized visitors, and Government personnel throughout the duration of the project. Cartridges shall be replaced according to the manufacturer's recommendations.

1.17.2 Protective Clothing

The Contractor shall furnish, at no cost to personnel, equipment/clothing for protection from airborne lead dust. An adequate supply of these items shall be available for worker, authorized visitor, and Government personnel use.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 WORK PROCEDURES

Work that disturbed painted surfaces shall be performed in accordance with the accepted Contractor’s Worker Protection Plan. Procedures and equipment required to limit occupational and environmental exposures to lead during disturbance of LCP surfaces shall be in accordance with \-29 CFR 1926-\ Section .62, and as specified herein.

3.1.1 Personnel Protection Procedures

Personnel shall wear and use protective clothing and equipment as specified in the Contractor’s Worker Protection Plan. Eating, smoking, drinking, chewing tobacco and chewing gum, and applying makeup shall not be permitted in the work control area. Electrical service shall be disconnected when wet removal is performed, and temporary electrical service protected by a ground fault circuit interrupter shall be provided.

3.1.2 Safety and Health Procedures and Responsibilities

The Competent Person shall be present on the work site throughout the project to supervise, monitor, document the project's health and safety provisions, and verify that the contractor’s Worker Protection Plan is implemented and followed. A daily log shall be maintained documenting the progress of work, results of sampling tests, and level of worker protection throughout the project area.

3.1.3 Engineering Controls

3.1.3.1 Hand Wash Station and Procedures

A shower and hand washing station shall be provided to the workers for washing their hands and face whenever exiting the work area and before eating, drinking or smoking. Workers shall be aware of hygiene practices prior to start any work.

3.1.3.2 Dust Suppression

During work described in this section, dust suppression methods shall be employed to minimize airborne lead dust. The method of dust suppression shall be described in the Contractor's Worker Protection Plan.

3.1.3.3 Storage of Materials

Materials shall be stored in a place and manner which protects them from damage and contamination. Stored materials shall not present a hazard or an inconvenience to workers, visitors, and/or other occupants at the adjacent area.

3.2 MONITORING

During demolition, a Competent Person shall be onsite directing the work, to ensure that health and safety requirements of this contract are met.

3.2.1 Personal Air Monitoring

Airborne concentrations of lead shall be collected and analyzed in accordance with \-29 CFR 1926-\ Section .62. Results shall be reported in micrograms per cubic meter of air. These air monitoring results shall be used to determine the effectiveness of engineering controls, the adequacy of PPE and to determine if proper work practices are being employed. The Contracting Officer shall be notified if any personal air monitoring result equals or exceeds 30 micrograms per cubic meter (ug/m^3)of air. The Contractor shall take steps to reduce the concentration of lead in the air.

3.3 CLEAN-UP AND Closure Report

3.3.1 Daily Clean-up

The Competent Person shall perform daily inspection to maintain the work area free of visible airborne dust and accumulations of debris. Daily cleanup of the work area is required. Dry sweep or compressed air shall not be used for cleanup.

3.3.2 Closure Report

Final Disposition Report shall be provided (see SUBMITTALS, SD-09 Reports in this section).

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02110

CLEARING AND GRUBBING

07/89

PART
1 GENERAL

1.1 REFERENCES (Not Applicable)

1.2 DEFINITIONS

1.2.1 Clearing

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared.

1.2.2 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas.

1.3 SUBMITTALS

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

SD-18 Records\

Materials Other Than Salable Timber\; *FIO*\.

Written permission to dispose of cleared and grubbed on private property shall be filed with the Contracting Officer.

1.4 DELETED.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CLEARING

Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the trunk of the tree or main branches. Cuts more than 1-1/2 inches in diameter shall be painted with an approved tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.2 GRUBBING

Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

3.4 DISPOSAL OF MATERIALS

3.4.1 Salable Timber

All felled timber from which saw logs, pulpwood, posts, poles, ties, mine props, or cordwood can be produced shall be considered as salable timber, and shall be trimmed of limbs and tops, sawed into salable lengths of 8 feet, and stockpiled at locations as directed. The disposal of the stockpiled timber will be by the Government.

3.4.2 Materials Other Than Salable Timber

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of outside the limits of Government-controlled land at the Contractor's responsibility, except when otherwise approved in writing. Such permission will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02221

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

1.2.1 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, Method C, abbreviated hereinafter as percent laboratory maximum density.

1.3 SUBMITTALS

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

SD-09, Test Report\

Field Density Tests\; *FIO*\.

The Contractor shall furnish certified test reports and analysis certifying that the satisfactory materials, nonexpansive fill, and capillary water barrier proposed for use at the project site conform to the specified requirements, and for all tests conducted in accordance with the PART 3 paragraph TESTING.

Testing of Backfill Materials\; *FIO*\.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials include materials classified in ASTM D 2487 as GW, **GM, GC,** GP, SW, **SP, SM, SC, SL, CL, and CH** and shall be free of trash, debris, roots or other organic matter, or stones larger than 3 inches in any dimension.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials include materials classified in ASTM D 2487 as Pt, OH, OL, **ML, MH,** and any other materials not defined as satisfactory.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

2.1.4 Nonexpansive Soils

Nonexpansive soils shall be satisfactory material having a plasticity index not less than 4 nor greater than 12 when tested in accordance with ASTM D 4318.

2.1.5 Select Soils

Select soils shall be a satisfactory material having a liquid limit of 35 percent or less and a plasticity index of not less than 4 nor greater than 20 when tested in accordance with ASTM D 4318.

2.2 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 1-1/2 inches and no more than 2 percent by weight shall pass the No. 4 size sieve.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

The areas within lines 5 feet outside of each building and structure line shall be cleared and grubbed of trees, stumps, roots, brush and other vegetation, debris, existing foundations, pavements, utility lines, structures, fences, and other items that would interfere with construction operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material, placed and compacted in accordance with paragraph FILLING AND BACKFILLING. Materials removed shall be disposed of outside the limits of Government-controlled property at the Contractor's responsibility].]

3.2 TOPSOIL

Topsoil shall be stripped to a depth **as directed by the Contracting Officer** below existing grade within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified hereinafter, and shall include trenching for utility and foundation drainage systems to a point 5 feet beyond the building line of each building and structure, excavation for outside grease interceptors, underground fuel tanks, and all work incidental thereto. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed and replaced with satisfactory material. Payment therefor will be made in conformance with the CHANGES clause of the CONTRACT CLAUSES. Satisfactory material removed below the depths indicated without specific direction of the Contracting Officer shall be replaced at no additional cost to the Government to the indicated excavation grade with satisfactory materials, except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.4 DRAINAGE AND DEWATERING

3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites so as to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed

so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

3.4.2 Dewatering

[amend 1]

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least <u>two</u> feet below the working level.

3.5 SHORING

Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

3.6 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered.

3.7 BLASTING

Blasting will not be permitted.

3.8 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to secure the required slope and shall be tamped if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 6 inches below the bottom of the pipe, and the overdepth shall be backfilled with satisfactory material placed and compacted in conformance with paragraph FILLING AND BACKFILLING.

3.9 BORROW

[amend 1]

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials **including nonexpansive soils for nonexpansive fill** shall be obtained **<u>off government controlled land at the contractor's expense.</u>**

3.10 EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this

section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Section 02225 EARTHWORK FOR ROADWAYS, RAILROADS AND AIRFIELDS.

3.11 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

[amend 1]

Excavation to final grade shall not be made until just before concrete is to be placed. For pile foundations, the excavation shall be stopped at an elevation of from 6 to 12 inches above the bottom of the footing before driving piles. After pile driving has been completed, the remainder of the excavation shall be completed to the elevations shown. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. **All soils** shall be protected from slaking or other erosion resulting from ponding or flow of water.

3.12 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials. **Provide a minimum of 3 feet of nonexpansive fill below the cappillary water barrier for all slab on grade construction. All fill placed below structural slabs shall be select.** (Select fill shall have a plasticity index between 4 and 15 and be compacted to 92% as specified in the table in paragraph 3.13) The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

3.13 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. **Nonexpansive soils shall be used in nonexpansive fill under building floor slabs and foundations. Removal and replacement of exsisting material with nonexpansive material shall be as specified in paragraph SUBGRADE PREPARATION. Where nonexpansive fill is indicated under floor slabs or foundations, all fill under such slabs or foundations shall be nonexpansive fill. The subgrade below the nonexpansive fill shall be loosened to a depth of 6 inches, moistened, manipulated, and recompacted as specified hereinafter.** Satisfactory materials shall be placed in horizontal layers not exceeding 8 inches in loose thickness, or 6 inches when hand-operated

compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade and shall include backfill for outside grease interceptors and underground fuel tanks. Backfill shall not be placed in wet or frozen areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 2 feet above sewer lines and 1 foot above other utility lines shall be free from stones larger than 1 inch in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

	Percent Laboratory maximum density	
	Cohesive material	Cohesionless material
Fill, embankment, and backfill		
Under structures, building slabs, steps, paved areas, around footings, and in trenches	90	95
Under sidewalks and grassed areas	85	90
Nonexpansive materials	Compacted to not less than 92 percent	
Select Fill	Compacted to not less than 92 percent	
Subgrade		
Under building slabs, steps, and paved areas, top 12 inches	90	95
Under sidewalks, top 6 inches	85	90
Under nonexpansive fill, top 6 inches	Compacted to not less than 92 percent	

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recompaction over underground utilities and heating lines shall be by hand tamping.

3.14 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with \-ASTM D 2922-\. When \-ASTM D 2922-\ is used, the calibration curves shall be checked and adjusted using only the sand cone method (ASTM D1556) at frequencies directed by Contracting Officer. \-ASTM D 2922-\results in a wet unit weight of soil and when using this method \-ASTM D 3017-\ shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in \-ASTM D 3017-\. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. \-ASTM D 2937-\ shall be used only for soft, fine-grained, cohesive soils. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

3.14.1 In-Place Densities

3.14.1.1 In-Place Density of Subgrades

One test per 1000 square foot or fraction thereof.

3.14.1.2 In-Place Density of Fills and Backfills

One test per 1000 square foot or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines. The density for each lift of fill or backfill materials for trenches, pits, building perimeters or other structures or areas less than 500 feet in width, which are compacted with hand or hand-operated machines shall be tested as follows: One test per each area less than 500 square feet, or one test for each 100 linear foot of long narrow fills 300 feet or more in length.

3.14.2 Moisture Content

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

3.14.3 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum

density values. One representative test per **????** cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

3.15 CAPILLARY WATER BARRIER

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.16 GRADING

Areas within 5 feet outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

3.17 SPREADING TOPSOIL

[amend 1]

All areas disturbed by construction operations excluding sidewalks, drives, and parking lots shall receive a minimum of 6" of topsoil. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of 2 inches by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing 100 to 160 pounds per linear foot of roller. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

3.18 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work shall be repaired and grades reestablished to the required elevations and slopes.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02222

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

07/89

PART 1 - GENERAL

1.1 REFERENCES

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

\-ASTM D 1556-\	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
\-ASTM D 1557-\	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
\-ASTM D 2167-\	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
\-ASTM D 2487-\	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System
\-ASTM D 2922-\	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 3017-\	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.2 DEFINITIONS

1.2.1 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in \-ASTM D 1557, [AM#1] Method C-\.

1.3 SUBMITTALS

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

SD-09 Reports\

Field Density Tests\; *FIO*\.

Testing of Backfill Materials\; *FIO*\.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials shall consist of any material classified by \-ASTM D 2487-\ as GC, GM, SP, SM, SC, CL, GW, GP, and SW.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than 3 inches, and materials classified in \-ASTM D 2487-\, as ML, MH PT, OH, and OL. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials shall include materials classified in \-ASTM D 2487-\ as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

2.1.4 Rock

Rock shall consist of boulders measuring 1/2 cubic yard or more and materials that cannot be removed without systematic drilling and blasting such as rock material in ledges, bedded deposits, unstratified masses and conglomerate deposits, and below ground concrete or masonry structures, exceeding 1/2 cubic yard in volume, except that pavements will not be considered as rock.

2.1.5 Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 3 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller.

2.1.6 Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure.

2.1.7 Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the l inch sieve. The maximum allowable aggregate size shall be 2 1/2

inches, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

2.1.8 Initial Backfill Material [AM#1]

Initial backfill shall consist of select granular material or satisfactory materials free from rocks 1 inch or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. Material shall comply with ASTM D448, size #6 or other approved approved size. When the pipe is coated or wrapped for corrosion protection, the initial backfill material shall be free of stones larger than 1 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

2.1.9 Plastic Marking Tape

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Blue:	Water Systems
Green:	Sewer Systems

2.1.10 Tracer wire shall be installed in the trench with the above mentioned utilities at __[AM#1] least 4 inches (minimum) below the utility line.

PART 3 - EXECUTION

3.1 EXCAVATION

Excavation shall be performed to the lines and grades indicated. Rock excavation shall include removal and disposition of material defined as rock in paragraph MATERIALS. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the

excavation. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.

3.1.1 Trench Excavation

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed, [AM#1] or as detailed on the drawings. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 4 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 5 feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter and shall not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

3.1.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 2 1/2 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

3.1.1.2 Removal of Unyielding Material

Where overdepth is not indicated and unyielding material is encountered in the bottom of the trench, such material shall be removed 4 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.1.1.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

3.1.1.4 Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the

full length and width of structure footings and foundations as shown. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.1.1.5 Jacking, Boring, and Tunneling

[AM#1] No open trenches shall be allowed to cross any existing street or road, unless this street or road is demolished in this contract. In cases where utility lines are routed near existing trees, the contractor shall bore through the existing trees' driplines. The contractor shall insure that boring does not penetrate the taproots of existing trees.

3.1.1.6 Stockpiles

Stockpiles of satisfactory unsatisfactory, and wasted materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government. Locations of stockpiles of satisfactory materials shall be subject to prior approval of the Contracting Officer.

3.2 BACKFILLING AND COMPACTION

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

3.2.1 Trench Backfill

Trenches shall be backfilled to the grade shown, [AM#1] and as detailed on the drawings. The trench shall be backfilled to 2 feet above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test. The trench shall not be backfilled until all specified tests are performed.

3.2.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material.

3.2.1.2 Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 6 inches loose thickness.

3.2.1.3 Bedding and Initial Backfill

Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

3.2.1.4 Final Backfill

The remainder of the trench, except for special materials for roadways, railroads and airfields, shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

a. Roadways: Backfill shall be placed up to the elevation at which the requirements in Section \=02225=\ EARTHWORK FOR ROADWAYS, RAILROADS, AND AIRFIELDS control. Water flooding or jetting methods of compaction will not be permitted.

b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Backfill shall be deposited in layers of a maximum of 12 inch loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Compaction by water flooding or jetting will not be permitted.This requirement shall also apply to all other areas not specifically designated above.

3.2.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 3 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and [AM#1] <u>compacted for density in 6 inch compacted lifts,</u> and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.3 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.3.1 Gas Distribution

Trenches shall be excavated to a depth that will provide not less than 18 inches of cover in rock excavation and not less than 24 inches of cover in other excavation. Trenches shall be graded as specified for pipe-laying requirements in Section \=02685=\ GAS DISTRIBUTION SYSTEM.

3.3.2 Water Lines

Trenches shall be of a depth to provide a minimum cover of 3 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. For fire protection yard mains or piping, an additional 12 inches of cover is required.

3.3.3 Heat Distribution System

Initial backfill material shall be free of stones larger than 1/4 inch in any dimension.

3.3.4 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated. Special trenching requirements for direct-burial electrical cables and conduits are specified in Section \=16375=\ ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

3.3.5 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise shown.

3.4 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

3.4.1 Testing Facilities

Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the first inspection will be charged to the Contractor.

3.4.2 *Testing of Backfill Materials*\

Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils \-ASTM D 422-\ and moisture-density relations of soils \-ASTM D 1557-\. A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

3.4.3 *Field Density Tests*\

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 100 feet of installation shall be performed. One moisture density relationship shall be determined for every 1500 cubic yards of material used. Field in-place density shall be determined in accordance with \-ASTM D 1556-\ or \-ASTM D 2922-\. When \-ASTM D 2922-\ is used, the calibration curves shall be checked and adjusted using the sand cone method as described in paragraph Calibration of the ASTM publication. \-ASTM D 2922-\ results in a wet unit weight of soil and when

using this method, \-ASTM D 3017-\ shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in \-ASTM D 3017-\. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the Contracting Officer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Contracting Officer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

3.4.4 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to 2 feet above the top of the pipe , the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 36 inches shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02225

EARTHWORK FOR ROADWAYS, RAILROADS, AND AIRFIELDS

12/94

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 136-\	(1995a) Sieve Analysis of Fine and Coarse Aggregates
\-ASTM D 422-\	(1963; R 1990) Particle-Size Analysis of Soils
\-ASTM D 1140-\	(1992) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
\-ASTM D 1556-\	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
\-ASTM D 1557-\	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
\-ASTM D 2167-\	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
\-ASTM D 2487-\	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
\-ASTM D 2922-\	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 2937-\	(1994) Density of Soil in Place by the Drive-Cylinder Method
\-ASTM D 3017-\	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 4318-\	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by, \-ASTM D 2487-\ as GW, GP, SW, GC, GM, SP, SC, SM, CL and CH. Satisfactory materials for grading shall be free from roots and other organic matter, trash, debris, and frozen materials and stones larger than 6 inches in any dimension.

1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in \-ASTM D 2487-\ as ML, MH, Pt, OH, and OL are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in \-ASTM D 2487-\ as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with \-ASTM D 4318-\, \-ASTM C 136-\, \-ASTM D 422-\, and \-ASTM D 1140-\.

1.2.4 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in \-ASTM D 1557-\ abbreviated as a percent of laboratory maximum density.

1.2.5 Topsoil

Material suitable for topsoils obtained from offsite areas and excavations and is defined as natural, friable surface soil possessing the characteristics of representative soils in the vicinity that produce a heavy growth of healthy crops, grass, or other vegetation.

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-08 Statements\

Earthwork\; *GA*\.

Procedure and location for disposal of unused satisfactory material. Blasting plan when blasting is permitted. Proposed source of borrow material.

SD-09 Reports\

Testing\; *FIO*\.

Within 24 hours of conclusion of physical tests, 6 copies of test results, including calibration curves and results of calibration tests.

SD-13 Certificates\

Testing\; *FIO*\.

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

SD-18 Records\

Earthwork\; *FIO*\.

Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

1.4 SUBSURFACE DATA

Subsurface soil boring logs are shown on the drawings. The subsoil investigation report is published as part of the Design Analysis. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.6 BLASTING

Blasting will not be permitted.

1.7 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of __[AM#1]off government controlled land, at the expense and responsibility of the contractor . Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or off __[AM#1] government controlled land, at the expense and responsibility of the contractor. Coarse rock from excavations shall be stockpiled as directed by the contracting officer.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 STRIPPING OF TOPSOIL

Unless directed otherwise by the contracting officer, topsoil shall be stripped to a depth of 6 inches. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate

from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be removed from the site.

3.2 EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in areas approved for surplus material storage __[AM#1] or off government controlled land, at the expense and responsibility of the contractor. Unsatisfactory excavated material shall be disposed of in designated waste or spoil areas. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas __[AM#1] off government controlled land, at the expense and responsibility of the contractor.

3.2.1 Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of as shown or as directed, except that in no case shall material be deposited less than 4 feet from the edge of a ditch. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed. Where pile foundations are to be used, the excavation of each pit shall be stopped at an elevation 1 foot above the base of the footing, as specified, before piles are driven. After the pile driving has been completed, loose and displaced material shall be removed

and excavation completed, leaving a smooth, solid, undisturbed surface to receive the concrete or masonry.

3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from __[AM#1] approved sources, either private or within the limits of the project site, selected by the Contractor. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. __[AM#1]Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

3.4 DELETED [AM#1].

3.5 GRADING AREAS

Where indicated, work will be divided into grading areas within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing.

3.6 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, and Section \=02720=\ STORM-DRAINAGE SYSTEM; and Section \=02222=\ EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.7 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up to a depth of 6 inches; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment

materials to assure adequate bond between embankment material and the prepared ground surface.

3.8 EMBANKMENTS

3.8.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. The material shall be placed in successive horizontal layers [AM#1] 8 inch loose lifts. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.9 RAW SUBGRADE PREPARATION

3.9.1 Construction

Raw subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 6 inches below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 3/8 inch when tested with a 10 foot straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finish subgrade shall not vary more than 0.05 foot from the established grade and cross section.

3.9.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, each layer of the embankment shall be compacted to at least 90 percent of laboratory maximum density.

3.9.2.1 Subgrade for Pavements

Subgrade for pavements shall be compacted to at least 90 percent of laboratory maximum density for the depth below the surface of the pavement shown.

3.10 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials.

3.11 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 2 inch depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness of 6 inches and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from off government controlled land, at the expense and responsibility of the contractor.

3.12 \+*TESTING*\+\

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. The first inspection be at the expense of the Government. Cost incurred for any subsequent inspections required because of failure of the first inspection will be charged to the Contractor. Field in-place density shall be determined in accordance with \-ASTM D 1556-\ or \-ASTM D 2922-\. When \-ASTM D 2922-\ is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in \-ASTM D 1556-\. \-ASTM D 2922-\ results in a wet unit weight of soil and when using this method \-ASTM D 3017-\ shall be used to determine the moisture content of the soil. The __[AM#1] density calibration checks as described in \-ASTM D 3017-\; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. \-ASTM D 2937-\, the Drive Cylinder Method shall be used only for soft, fine-grained, cohesive soils. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be __[AM#1] recompacted to meet specification requirements. Tests on recompacted areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.12.1 \+Fill and Backfill Material Gradation+\

One test per 2000 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with \-ASTM C 136-\, \-ASTM D 422-\ or \-ASTM D 1140-\.

3.12.2 \+In-Place Densities+ [AM#1]

a. One test per 2000 square yards or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 1000 square yards, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

c. One test per 100 linear feet, or fraction thereof, of each lift of embankment or backfill for roads.

3.12.3 \+Check Tests on In-Place Densities+ [AM#1]

If \-ASTM D 2922-\ is used, in-place densities shall be checked by \-ASTM D 1556-\ as follows:

a. One check test per lift for each 10,000 square yards, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.

b. One check test per lift for each square feet, of fill or backfill areas compacted by hand-operated machines.

c. One check test per lift for each 5000 linear feet, or fraction thereof, of embankment or backfill for roads.

d. DELETED.

3.12.4 \+Moisture Contents+

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

3.12.5 \+Optimum Moisture and Laboratory Maximum Density+

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 2000 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.12.6 \+Tolerance Tests for Subgrades+

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

3.13 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02234

SUBBASE COURSE

03/89

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

\-AASHTO T 180-\	(1993) Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in (457 mm) Drop

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 29-\	(1991a) Unit Weight and Voids in Aggregate
\-ASTM C 117-\	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
\-ASTM C 131-\	(1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
\-ASTM C 136-\	(1995a) Sieve Analysis of Fine and Coarse Aggregates
\-ASTM D 75-\	(1987; R 1992) Sampling Aggregates
\-ASTM D 1556-\	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
\-ASTM D 1557-\	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
\-ASTM D 2167-\	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
\-ASTM D 2487-\	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
\-ASTM D 2922-\	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

\-ASTM D 3017-\	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 4318-\	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
\-ASTM E 11-\	(1995) Wire-Cloth Sieves for Testing Purposes

1.2 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in [AM#1] \-ASTM D 1557, Method C-\. This will be abbreviated herein after as percentage of laboratory maximum density.

1.3 SUBMITTALS

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

SD-01 Data\

Equipment\; *FIO*\.

List of proposed equipment to be used in performance of construction work, including descriptive data.

SD-09 Reports\

Sampling and Testing\; *FIO*\.

Copies of Test Results.

SD-18 Records\

Waybills and Delivery Tickets\; *FIO*\.

Copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all aggregates actually used.

1.4 *SAMPLING AND TESTING*\

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor subject to approval. If the Contractor elects to establish testing facilities of his own, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities shall be at the expense of the Government and any subsequent inspections required because of failure of the first inspection will be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor. The materials shall be tested to establish compliance with the specified requirements.

1.4.1 Sampling

Sampling for laboratory testing shall be in conformance with \-ASTM D 75-\. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with \-ASTM C 117-\ and \-ASTM C 136-\. Sieves shall conform to \-ASTM E 11-\. A minimum of one analysis shall be performed for each 900,000 kg (2,000 lbs)[AM#1] or fraction thereof, of material placed, [AM#1] <u>or at least one sieve analysis per 8 hour shift that material is delivered.</u>

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with \-ASTM D 4318-\. One test each for liquid limit and plasticity index shall be performed for each sieve analysis.

1.4.2.3 Density Tests

Density shall be measured in the field in accordance with \-ASTM D 1556-\, \-ASTM D 2167-\ or \-ASTM D 2922-\. For the method presented in \-ASTM D 1556-\ the base plate as shown in the drawing shall be used. For the method presented in \-ASTM D 2922-\ the calibration curves shall be checked, and adjusted if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with \-ASTM D 2922-\ result in a wet unit weight of soil and when using this method, \-ASTM D 3017-\ shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in \-ASTM D 3017-\. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration, in \-ASTM D 2922-\, on each different type of material to be tested at the beginning of a job and at intervals as directed. At least one field density test shall be performed for each 800 square meters (8600 square feet) of each 150 mm (6 inch)[AM#1] thick layer of compacted material or fraction thereof.

1.4.2.4 Wear Test

Wear tests shall be made in conformance with \-ASTM C 131-\. One test shall be run for each 400 square meters (4300 square feet)[AM#1] of completed subbase course, or fraction thereof.

1.4.2.5 Laboratory Maximum Density

At least one test for moisture density relationship shall be run for each type of material or combination of material.

1.4.2.6 Thickness

At least one measurement for each 400 square meters (4300 square feet)[AM#1] of subbase course. Weight per cubic meter of slag shall be determined in accordance with \-ASTM C 29-\.

1.4.3 Approval of Material

The source of the material shall be selected 30 days prior to the time the material will be required in the work. Tentative approval of the source will be based on an inspection by the Contracting Officer. Tentative approval of material will be based on tests of samples for the specific job. Final approval of both the source and the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted subbase course.

1.5 WEATHER LIMITATIONS

Subbase courses shall be constructed when the atmospheric temperature is above 2 degrees C (35 degrees F). When the temperature falls below 2 degrees C (35 degrees F)[AM#1], the Contractor shall protect all areas of completed subbase course by approved methods against detrimental effects of freezing. Areas of completed subbase course damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 *EQUIPMENT*

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 MATERIALS

Aggregates shall consist of crushed stone or slag, gravel, shell, sand, or other sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. Material retained on the 4.75 mm (No. 4) sieve shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested as specified in \-ASTM C 131-\. Aggregate shall be reasonably uniform in density and quality. Slag shall be an air-cooled, blast-furnace product having a dry weight of not less than 1050 kg per cubic meters (65 lbs/sq. ft.)[AM#1]. Aggregates shall have a maximum size of 50 millimeter(s) (2 inch(s)) and shall be within the limits specified as follows:

Sieve Designation	Maximum Allowable Percentage by Weight Passing Square-Mesh Sieve

2 mm (No. 10)	--
0.075 mm (No. 200)	15

The portion of any blended component and of the completed course passing the 0.425 mm (No. 40)[AM#1] shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 5. [AM#1] Or, at the contractor's option, the contractor may use material conforming to Texas Department of Transportation Standard Specification, Item 247, Type A, grade I/II.

PART 3 EXECUTION

3.1 OPERATION OF AGGREGATE SOURCES

Aggregate sources on private lands shall be conditioned in agreement with local laws and authorities.

3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.3 PREPARATION OF UNDERLYING MATERIAL

Prior to constructing the subbase course, the underlying course shall be cleaned of all foreign substances. Subgrade shall conform to the requirements of Section \=02225=\ EARTHWORK FOR ROADWAYS, RAILROADS, AND AIRFIELDS. Ruts or soft, yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in \-ASTM D 2487-\, the surface shall be stabilized prior to placement of the subbase course. Stabilization shall be accomplished by mixing subbase-course material into the underlying course, and compacting by approved methods. The stabilized material will be considered as part of the underlying course and shall meet all requirements for the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the subbase course is placed.

3.4 GRADE CONTROL

The finished and completed subbase course shall conform to the lines, grades, and cross sections shown. The lines, grades, and cross sections shown shall be maintained by means of line and grade stakes placed by the Contractor at the site of the work.

3.5 MIXING AND PLACING MATERIALS

The materials shall be mixed and placed in such a manner as to obtain uniformity of the subbase material and at the water content specified. The Contractor shall make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory subbase course.

3.6 LAYER THICKNESS

The compacted thickness of the subbase course shall be as indicated. When a compacted layer of 150 mm (6 inches) is specified, the material may be placed in a single layer; when a compacted thickness of more than 150 mm (6 inches) is required, no layer shall exceed 150 mm (6 inches) nor be less than 75 mm (3 inches) when compacted.

3.7 COMPACTION

Each layer of the subbase course shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure such that the water content is within plus or minus 1 percent of optimum water content as determined from laboratory tests as specified in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer is compacted through the full depth to at least 100 percent of laboratory maximum density. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory subbase course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

3.8 EDGES OF SUBBASE COURSE

Approved material shall be placed along the edges of the subbase course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 300 mm (12 inches) width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the subbase course, as directed.

3.9 SMOOTHNESS TEST

The surface of each layer shall not show deviations in excess of 9.5 mm (3/8 inch) when tested with a 3.05 mm (10 foot) straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed.

3.10 THICKNESS CONTROL

The completed thickness of the subbase course shall be in accordance with the thickness and grade indicated on the drawings. The thickness measurement shall be made by test holes, at least 75 mm (3 inches) in

diameter through the course. The completed subbase course shall not be more than 13 mm (1/2 inch) deficient in thickness nor more than 13 mm (1/2 inch) above or below the established grade. Where any of these tolerances are exceeded, the Contractor shall correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness of the subbase course is 13 mm (1/2 inch) or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 13 mm (1/2 inch). The average job thickness shall be the average of the job measurements as specified above but within 6 mm (1/4 inch) of the thickness shown.

3.11 MAINTENANCE

The subbase course shall be maintained in a satisfactory condition until accepted.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02240

LIME-STABILIZED BASE COURSE, SUBBASE, OR SUBGRADE

02/89

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

\-AASHTO M 81-\	(1992) Cut-Back Asphalt (Rapid-Curing Type)
\-AASHTO M 82-\	(1975; Rev 1986) Cut-Back Asphalt (Medium-Curing Type)
\-AASHTO T 135-\	(1992) Wetting-and-Drying Test of Compacted Soil-Cement Mixtures
\-AASHTO T 136-\	(1992) Freezing-and-Thawing Tests of Compacted Soil-Cement Mixtures

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 25-\	(1995a) Chemical Analysis of Limestone, Quicklime, and Hydrated Lime
\-ASTM C 50-\	(1994) Sampling, Inspection, Packing, and Marking of Lime and Limestone Products
\-ASTM C 136-\	(1995a) Sieve Analysis of Fine and Coarse Aggregates
\-ASTM D 75-\	(1987; R 1992) Sampling Aggregates
\-ASTM D 422-\	(1963; R 1990) Particle-Size Analysis of Soils
\-ASTM D 490-\	(1992) Road Tar
\-ASTM D 559-\	(1989) Wetting and Drying Compacted Soil-Cement Mixtures
\-ASTM D 560-\	(1989) Freezing and Thawing Compacted Soil-Cement Mixtures
\-ASTM D 633-\	(1987; R 1991) Volume Correction Table for Road Tar
\-ASTM D 977-\	(1991) Emulsified Asphalt

\-ASTM D 1250-\	(1980; R 1990) Petroleum Measurement Tables
\-ASTM D 1556-\	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
\-ASTM D 1557-\	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
\-ASTM D 1632-\	(1987) Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory
\-ASTM D 1633-\	(1984; R 1990) Compressive Strength of Molded Soil-Cement Cylinders
\-ASTM D 2027-\	(1976; R 1992) Cutback Asphalt (Medium-Curing Type)
\-ASTM D 2028-\	(1976; R 1992) Cutback Asphalt (Rapid-Curing Type)
\-ASTM D 2167-\	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
\-ASTM D 2922-\	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 3017-\	(1988; R 1993) Water Content of Soil and Rock in Place By Nuclear Methods (Shallow Depth)
\-ASTM D 4318-\	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
\-ASTM E 11-\	(1995) Wire-Cloth Sieves for Testing Purposes

1.2 Lime-Stabilized Base Course, Subbase, or Subgrade

Lime-stabilized course, as used herein, is a mixture of lime and in-place or select borrow material uniformly blended, wetted, and thoroughly compacted to produce a pavement course which meets all criteria as set forth in the plans and this specification.

1.2.1 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in \-ASTM D 1557-\abbreviated hereinafter as percent laboratory maximum density.

1.3 GENERAL

The work specified herein consists of the construction of a lime-stabilized subgrade course. The work shall be performed in accordance with this specification and shall conform to the lines, grades, notes, and typical sections shown in the plans. Sources of all materials shall be selected well in advance of the time when materials will be required in the work.

1.4 SUBMITTALS

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

SD-01 Data\

Plant, Equipment, Machines, and Tools\; *FIO*\.

Mix Design\; *FIO*\.

List of proposed equipment to be used in performance of construction work including descriptive data. Mix design at least 30 days before it is to be used.

SD-09 Reports\

Sampling and Testing\; *FIO*\.

Field Density\; *FIO*\.

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results of materials and sources not less than 30 days before material is required for the work.

SD-18 Records\

Waybills and Delivery Tickets\; *FIO*\.

Copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all materials actually used.

1.5 STOCKPILING MATERIALS

Select material, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Before stockpiling material, storage sites shall be cleared and sloped to drain. Materials obtained from different sources shall be stockpiled separately.

1.6 *PLANT, EQUIPMENT, MACHINES, AND TOOLS*\

1.6.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in satisfactory working condition at all times. Other compacting equipment may be used in lieu of that specified, where it can be demonstrated that the results are equivalent. The equipment shall be adequate and have the capability of producing the results specified in Protective equipment, apparel, and barriers shall be provided to protect the eyes, respiratory system, and the skin of workers

exposed to contact with lime dust or slurry. Lime shall only be applied by a slurry method. [AM#1]

1.6.2 Steel-Wheeled Rollers

Steel-wheeled rollers shall be the self-propelled type weighing not less than 10 tons, with a minimum weight of 300 pounds per inch width of rear wheel. Wheels of the rollers shall be equipped with adjustable scrapers. The use of vibratory rollers is optional.

1.6.3 Pneumatic-Tired Rollers

Pneumatic-tired rollers shall have four or more tires, each loaded to a minimum of 30,000 pounds and inflated to a minimum pressure of 150 psi. The loading shall be equally distributed to all wheels, and the tires shall be uniformly inflated. Towing equipment shall also be pneumatic-tired.

1.6.4 Lime shall be added to soil by water truck method. [AM#1]

1.6.5 Sprinkling Equipment

Sprinkling equipment shall consist of tank trucks, pressure distributors, or other approved equipment designed to apply controlled quantities of water uniformly over variable widths of surface.

1.6.6 Tampers

Tampers shall be of an approved mechanical type, operated by either pneumatic pressure or internal combustion, and shall have sufficient weight and striking power to produce the compaction required.

1.6.7 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 10 foot straightedge for each bituminous paver, for use in the testing of the finished surface. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.7 WEATHER LIMITATIONS

Work on the base course shall not be performed during freezing temperatures. When the temperature is below 40 degrees F, the completed base course shall be protected against freezing by a sufficient covering of straw, or by other approved methods, until the course has dried out. Any areas of completed base course that are damaged by freezing, rainfall, or other weather conditions shall be brought to a satisfactory condition in conformance with this specification without additional cost to the Government. Lime shall not be applied when the atmospheric temperature is less than 40 degrees F. No lime shall be applied to soils that are frozen or contain frost, or when the underlying material is frozen. If the temperature falls below 35 degrees F, completed lime-treated areas shall be protected against any detrimental effects of freezing.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Lime

Lime shall be a standard brand of hydrated lime conforming to the following physical and chemical requirements:

a. Lime shall be of such gradation that 99-1/2 percent passes a No. 20 sieve and a minimum of 85 percent passes a No. 100 sieve.

b. Combined calcium oxide and magnesium oxide shall be not less than 70 percent.

2.1.2 Bituminous Material

Material shall conform to one of the following:

2.1.2.1 Cutback Asphalt

ASTM D 2027, Grade MC 30. {AM#1]

2.1.2.2 Deleted [AM#1].

2.1.2.3 Material to be Stabilized

Material to be stabilized shall consist of in-place material in the area or approved select material. Select material shall be free of deleterious substances such as sticks, debris, organic matter, and stones greater than 3 inches in any dimension. At least 10 percent of the material shall pass the No. 40 sieve. Plasticity index shall be greater than 12.

2.1.3 Water

Water shall be clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, and other substances deleterious to the lime or soil-lime mixture, and shall be subject to approval.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

3.1.1 Deleted. [AM#1]

3.1.2 Lime Stabilization Mixture

The material to be stabilized shall be thoroughly pulverized. The rate of application of the lime for the soil-lime mixture shall be at least 6 percent by dry weight of the soil and the optimum moisture content shall be determined from soil samples. [AM#1] After mixing is completed, the proportions of the mixture shall be in accordance with the approved mix design. After blending, water shall be blended into the dry mix in amounts necessary to bring the moisture content to optimum. Field moisture content shall be controlled within plus or minus 2 percent of optimum. When the stabilized course is constructed in more than one layer, the previously

constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweeper or power brooms except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire construction period to prevent water from collecting or standing on the area to be stabilized or on pulverized, mixed, or partially mixed material. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF BORROW PITS

Borrow material shall be obtained from off government controlled land, at the expense and responsibility of the contractor [AM#1].

3.3 PREPARATION OF AREA TO BE STABILIZED

The area shall be cleaned of debris. The area will be inspected for adequate compaction and shall be capable of withstanding without displacement the compaction specified for the soil-lime mixture. Debris and removed unsatisfactory in-place material shall be disposed of as specified.

3.3.1 In-Place Material to be Stabilized

The entire area shall be graded to conform to the lines, grades, and cross sections shown in the plans prior to being processed. Soft or yielding subgrade areas shall be made stable before construction is begun.

3.3.2 In-Place Material to Receive Stabilized Course

Soft, yielding areas and ruts or other irregularities in the surface shall be corrected. The material in the affected areas shall be loosened and unsatisfactory material removed. Approved select material shall be added where directed. The area shall then be shaped to line, grade, and cross section, and shall be compacted to the specified density. Subgrade shall conform to Section 02225 - EARTHWORK FOR ROADWAYS, RAILROADS. Subbase course shall conform to Section 02234 - SUBBASE COURSE.

3.3.3 Select Material

Sufficient select material shall be utilized to provide the required thickness of the soil-lime layer after compaction. Where in-place mixing is to be accomplished, the soil shall be graded and shaped to the approximate section and grade shown before lime stabilization is undertaken.

3.3.4 Grade Control

Underlying material shall be excavated to sufficient depth for the required stabilized-course thickness so that the finished stabilized course with the subsequent surface course will meet the fixed grade. Finished and completed stabilized area shall conform to the lines, grades, cross section, and dimensions indicated.

3.4 INSTALLATION

3.4.1 Mixed In-Place Method

3.4.1.1 Scarifying and Pulverizing of Soil

Prior to application of lime, the soil shall be scarified and pulverized to the depth shown. Scarification shall be carefully controlled so that the layer beneath the layer to be treated is not disturbed. Depth of pulverizing shall not exceed the depth of scarification.

3.4.1.2 Application of Lime

Pulverized material shall be shaped to approximately the cross section indicated. Lime shall be applied so that when uniformly mixed with the soil, the specified lime content is obtained, and a sufficient quantity of lime-treated soil is produced to construct a compacted lime-treated course conforming to the lines, grades, and cross section indicated. Mechanical spreaders shall be used in applying bulk lime. Distributors shall be used in applying slurry. ___[AM#1].

3.4.1.3 Initial Mixing

Immediately after the lime has been distributed, the lime and soil shall be mixed. Initial mixing shall be sufficient to alleviate any dusting or wetting of the lime that might occur in the event of wind or rainstorms. This may be accomplished several days in advance of the final application and mixing.

3.4.1.4 Water Application and Moist Mixing

Moisture content of the mixture will be determined in preparation for final mixing. Moisture in the mixture following final mixing shall not be less than the water content determined to be optimum based on dry weight of soil and shall not exceed the optimum water content by more than 2 percentage points. Water may be added in increments as large as the equipment will permit; however, such increment of water shall be partially incorporated in the mix to avoid concentration of water near the surface. After the last increment of water has been added, mixing shall be continued until the water is uniformly distributed throughout the full depth of the mixture. Particular care shall be taken to ensure satisfactory moisture distribution along the edges of the section.

3.4.2 Edges of Stabilized Course

Approved material shall be placed along the edges of the stabilized course in such quantity as will compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple-layer course, allowing at least a 1 foot width of the shoulder to be rolled and compacted simultaneously with the rolling and compacting of each layer of the stabilized course.

3.4.3 Central-Plant Method

Plant shall be capable of producing a uniform lime-treated mixture at the specified lime and moisture contents. Mixture shall be hauled to the job in trucks equipped with protective covers. Underlying course shall be

thoroughly moistened and the mixture then placed on the prepared area in a uniform layer with mechanical spreaders. The layer shall be uniform in thickness and surface contour and in such quantity that the completed layer, after compaction, will conform to the required grade and cross section.

3.4.4 Traveling-Plant Method

Traveling plant shall move at a uniform rate of speed and shall accomplish thorough mixing of the materials in one pass. Water and lime shall be delivered from supply trucks or bins at a predetermined rate. Windrows of prepared soil-lime mixture shall be of sufficient size to cover a predetermined width to the indicated compacted thickness.

3.4.5 Layer Thickness

Compacted thickness of the stabilized course shall be as indicated No layer shall be more than 8 inches or less than 4 inches in compacted thickness.

3.4.6 Compaction

Before compaction operations are started and as a continuation of the mixing operation, the mixture shall be thoroughly loosened and pulverized to the full depth. Compaction shall be started immediately after mixing is completed. During final compaction, the surface shall be moistened, if necessary, and shaped to the required lines, grades, and cross section. Density of compacted mixture shall be at least 95 percent of laboratory maximum density. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. The speed of the roller at all times shall be such that displacement of the mixture does not occur. Areas inaccessible to the rollers shall be compacted with mechanical tampers, and shall be shaped and finished by hand methods.

3.4.7 Finishing

The surface of the top layer shall be finished to the grade and cross section shown. The surface shall be of uniform texture. Light blading during rolling may be necessary for the finished surface to conform to the lines, grades, and cross sections. Should the surface for any reason become rough, corrugated, uneven in texture, or traffic-marked prior to completion, such unsatisfactory portions shall be scarified, reworked, relaid, or replaced as directed. Should any portion of the course, when laid, become watersoaked for any reason, that portion shall be removed immediately, and the mix placed in a windrow and aerated until a moisture content within the limits specified is obtained, and then spread, shaped, and rolled as specified above.

3.4.8 Construction Joints

At the end of each phase of construction, a straight transverse construction joint shall be formed by cutting back into the completed work to form a true vertical face free of loose or shattered material. Material along construction joints not properly compacted shall be removed and

replaced with soil-lime mixture that is mixed, moistened, and compacted as specified.

3.4.9 Curing and Protection

Immediately after the soil-lime area has been finished as specified above, the surface shall be protected against rapid drying for 7 days.

3.4.9.1 Bituminous Material

Bituminous material shall be uniformly applied by means of a bituminous distributor within a temperature range of 130 degrees F and 220 degrees F. Bituminous material shall be applied in quantities of not less than 0.1 gallon per square yard nor more than 0.25 gallon per square yard. Areas inaccessible to or missed by the distributor shall be properly treated using the manually operated hose attachment. Bituminous material shall be applied only to the top layer. At the time the bituminous material is applied, the surface of the area shall be free of loose or foreign matter and shall contain sufficient moisture to prevent excessive penetration of the bituminous material. When necessary, the area shall be sprinkled immediately before the bituminous material is applied. Treated surface shall be sanded or dusted to prevent the bituminous material from being picked up by traffic.

3.5 *SAMPLING AND TESTING*

3.5.1 General Requirements

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the facilities to pass the first inspection will be charged to the Contractor. Tests shall be performed in sufficient numbers and at the locations and times directed to insure that materials and compaction meet specified requirements. Certified copies of the test results shall be furnished to the Contracting Officer.

3.5.2 Results

Results shall verify that the material complies with the specification. When the source of materials is changed or deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced.

3.5.3 Sampling

All aggregate samples for laboratory testing shall be taken in accordance with \-ASTM D 75-\. Samples of lime shall be taken in accordance with \-ASTM C 50-\. Specimens for the unconfined compression tests shall be prepared in accordance with \-ASTM D 1632-\.

3.5.4 \+Sieve Analysis+

Before starting work, one sample of material to be stabilized shall be tested in accordance with \-ASTM C 136-\ and \-ASTM D 422-\ on sieves conforming to \-ASTM E 11-\. After the initial test, a minimum of one analysis shall be performed for each 1000 tons of material placed, with a minimum of three analyses for each day's run until the course is completed.

3.5.5 \+Liquid Limit and Plasticity Index+\

One liquid limit and plasticity index shall be performed for each sieve analysis. Liquid limit and plasticity index shall be in accordance with \-ASTM D 4318-\.

3.5.6 \+Chemical Analysis+\

Lime shall be tested for the specified chemical requirements in accordance with \-ASTM C 25-\. Three tests shall be conducted for each delivery of lime.

3.5.7 \+Testing+\

Unconfined compression tests shall be conducted in accordance with \-ASTM D 1633-\. Three tests shall be conducted for each mix design tested. Samples shall be cured at a constant moisture content and temperature for 28 days. Three tests shall be conducted for each mix design tested. Scratch portion of the test shall be omitted.

3.6 FIELD QUALITY CONTROL

3.6.1 General

Tests shall provide a moisture-density relationship for the lime-soil mixture. Results of field quality control testing shall verify that materials comply with this specification. When a material source is changed, the new material shall be tested for compliance. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced or repaired, as directed by the Contracting Officer, at no additional cost to the Government.

3.6.2 Thickness Control

Completed thicknesses of the stabilized course shall be within 1/2 inch of the thickness indicated. Where the measured thickness of the stabilized course is more than 1/2 inch deficient, such areas shall be corrected by scarifying, adding mixture of proper gradation, reblading, and recompacting as directed. Where the measured thickness of the stabilized course is more than 1/2 inch thicker than indicated, it shall be considered as conforming to the specified thickness requirement. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated. Thickness of the stabilized course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square yards of stabilized course. Measurements shall be made in 3 inch diameter test holes penetrating the stabilized course.

3.6.3 \+*Field Density*\+\

Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked, and adjusted if necessary, using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 at least once per lift for each 1200 square yard of stabilized material. Calibration curves and calibration tests results shall be furnished to the Contracting Officer within 24 hours of conclusion of the tests. At least one field density test shall be performed for each 250 square yards of each layer of base material.

3.7 TRAFFIC

Completed portions of the lime-treated soil area may be opened immediately to light traffic provided the curing is not impaired. After the curing period has elapsed, completed areas may be opened to all traffic, provided the stabilized course has hardened sufficiently to prevent marring or distorting of the surface by equipment or traffic. Heavy equipment shall not be permitted on the area during the curing period. Lime and water may be hauled over the completed area with pneumatic-tired equipment if approved. Finished portions of lime-stabilized soil that are traveled on by equipment used in constructing an adjoining section shall be protected in a manner to prevent equipment from marring or damaging completed work.

3.8 MAINTENANCE

Stabilized area shall be maintained in a satisfactory condition until the completed work is accepted. Maintenance shall include immediate repairs of any defects and shall be repeated as often as necessary to keep the area intact. Defects shall be corrected as specified herein.

3.9 DISPOSAL OF UNSATISFACTORY MATERIALS

Removed in-place materials that are unsuitable for stabilization, material that is removed for the required correction of defective areas, waste material, and debris shall be disposed of off government controlled land, at the expense and responsibility of the contractor.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02241

AGGREGATE BASE COURSE

04/92

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 29-\	(1991a) Unit Weight and Voids in Aggregate
\-ASTM C 127-\	(1988; R 1993) Specific Gravity and Absorption of Course Aggregate
\-ASTM C 128-\	(1993) Specific Gravity and Absorption of Fine Aggregate
\-ASTM C 131-\	(1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
\-ASTM C 136-\	(1995a) Sieve Analysis of Fine and Coarse Aggregates
\-ASTM D 75-\	(1987; R 1992) Sampling Aggregates
\-ASTM D 422-\	(1963; R 1990) Particle-Size Analysis of Soils
\-ASTM D 1556-\	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
\-ASTM D 1557-\	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-1bf/cu. ft. (2,700 kN-m/cu. m.))
\-ASTM D 2167-\	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
\-ASTM D 2922-\	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 3017-\	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 4318-\	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

\-ASTM E 11-\ (1995) Wire-Cloth Sieves for Testing Purposes

TEXAS DEPARTMENT OF TRANSPORTATION

Standard Specifications for Construction of Highways, Streets, and Bridges, 1993.

1.2 DEFINITIONS

1.2.1 Aggregate Base

Aggregate base as used herein is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in [AM#1] \-ASTM D 1557, Method C.-\ abbreviated hereinafter as percent laboratory maximum density.

1.3 GENERAL

The work specified herein consists of the construction of an aggregate base course. The work shall be performed in accordance with this specification and shall conform to the lines, grades, notes and typical sections shown in the plans. Sources of all materials shall be selected well in advance of the time that materials will be required in the work.

1.4 SUBMITTALS

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

SD-01 Data\

Plant, Equipment, Machines, and Tools\; *FIO*\.

List of proposed equipment to be used in performance of construction work including descriptive data.

SD-09 Reports\

Sampling and Testing\; *FIO*\.

Field Density\; *FIO*\.

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 30 days before material is required for the work.

SD-18 Records\

Waybills and Delivery Tickets\; *FIO*\.

Coarse Aggregate\; *FIO*\.

Copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all materials actually used. A notification stating which type of coarse aggregate is to be used.

1.5 WEATHER LIMITATIONS

Base shall not be constructed when the atmospheric temperature is less than 2 degrees C. Base shall not be constructed on subgrades that are frozen or contain frost. If the temperature falls below 2 degrees C, completed areas shall be protected against any detrimental effects of freezing.

1.6 *PLANT, EQUIPMENT, MACHINES, AND TOOLS*\

1.6.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in satisfactory working condition at all times. Other compacting equipment may be used in lieu of that specified, where it can be demonstrated that the results are equivalent. The equipment shall be adequate and have the capability of producing the results specified.

1.6.2 Steel-Wheeled Rollers

Steel-wheeled rollers shall be the self-propelled type weighing not less than 9 metric tons (10 tons), with a minimum weight of 135 kilograms per millimeter (1200 lbs. per inch)[AM#1] width of rear wheel. Wheels of the rollers shall be equipped with adjustable scrapers. The use of vibratory rollers is optional.

1.6.3 Pneumatic-Tired Rollers

Pneumatic-tired rollers shall have four or more tires, each loaded to a minimum of 13,600 kilograms (30,000 lbs.) and inflated to a minimum pressure of 1035 kPa (150 psi)[AM#1]. The loading shall be equally distributed to all wheels, and the tires shall be uniformly inflated. Towing equipment shall also be pneumatic-tired.

1.6.4 Mechanical Spreader

Mechanical spreader shall be self-propelled or attached to a propelling unit capable of moving the spreader and material truck. The device shall be steerable and shall have variable speeds forward and reverse. The spreader and propelling unit shall be carried on tracks, rubber tires, or drum-type steel rollers that will not disturb the underlying material. The spreader shall contain a hopper, an adjustable screed, and outboard bumper rolls and be designed to have a uniform, steady flow of material from the hopper. The spreader shall be capable of laying material without segregation across the full width of the lane to a uniform thickness and to a uniform loose density so that when compacted, the layer or layers shall conform to thickness and grade requirements indicated. The

Contracting Officer may require a demonstration of the spreader prior to approving use in performance of the work.

1.6.5 Sprinkling Equipment

Sprinkling equipment shall consist of tank trucks, pressure distributors, or other approved equipment designed to apply controlled quantities of water uniformly over variable widths of surface.

1.6.6 Tampers

Tampers shall be of an approved mechanical type, operated by either pneumatic pressure or internal combustion, and shall have sufficient weight and striking power to produce the compaction required.

1.6.7 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 3.05 meter (10 foot) straightedge for each bituminous paver, for use in the testing of the finished surface. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to ensure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.7 STOCKPILING MATERIALS

Materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at locations designated. Before stockpiling of material, storage sites shall be cleared, and sloped to drain. Materials obtained from different sources shall be stockpiled separately.

1.8 *SAMPLING AND TESTING*\

1.8.1 General Requirements

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing shall be permitted until the facilities have been inspected and approved. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the facilities to pass the first inspection will be charged to the Contractor. Tests shall be performed in sufficient numbers and at the locations and times directed to insure that materials and compaction meet specified requirements. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of tests.

1.8.2 Test Results

Results shall verify that materials comply with this specification. When a material source is changed, the new material will be tested for compliance. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine

the extent of unacceptable material. All in-place unacceptable material shall be replaced or modified as directed by the Contracting Officer.

1.8.3 Sampling

Aggregate samples for laboratory tests shall be taken in accordance with \-ASTM D 75-\.

1.8.4 Sieve Analysis

Before starting work, at least one sample of material shall be tested in accordance with \-ASTM C 136-\ and \-ASTM D 422-\ on sieves conforming to \-ASTM E 11-\. After the initial test, a minimum of one analysis shall be performed for each 1000 metric tons of material placed, with a minimum of three analyses for each day's run until the course is completed.

1.8.5 Liquid Limit and Plasticity Index

One liquid limit and plasticity index shall be performed for each sieve analysis. Liquid limit and plasticity index shall be in accordance with \-ASTM D 4318-\.

1.8.6 Laboratory Density

Tests shall provide a moisture-density relationship for the aggregate. Tests shall be conducted in accordance with \-ASTM D 1557-\.

1.8.7 Weight Per Cubic Meter of Slag

Weight per cubic meter of slag shall be determined in accordance with \-ASTM C 29-\.

1.8.8 Wear Tests

Wear tests shall be performed in accordance with \-ASTM C 131-\. One test shall be run per 2500 square meter (2700 square yards)[AM#1] of completed base course. A minimum of one test per aggregate source shall be run.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates

Aggregates shall consist of crushed stone or slag, crushed gravel, angular sand, or other approved material. Aggregates shall be durable and sound, free from lumps of clay, organic matter, objectionable coatings, and other foreign material. Material retained on a 4.75 mm (No. 4) sieve shall be known as coarse aggregate and that passing the 4.75 mm (No. 4) sieve shall be known as binder material.[AM#1}

2.1.1.1 *Coarse Aggregate*

Only one type of coarse aggregate shall be used on the project. Coarse aggregates, consisting of angular fragments of uniform density and quality, shall have a percentage of wear not to exceed 50 percent after

500 revolutions when tested in accordance with \-ASTM C 131-\. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3, and an elongated particle is one having a ratio of length to width greater than 3.

a. Crushed Gravel: Crushed gravel shall be manufactured from gravel particles 50 percent of which by weight are retained on the maximum size gradation sieve specified.

b. Crushed Stone: Crushed stone retained on each sieve specified shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are adjacent, the angle between the planes of the fractures must be at least 30 degrees to count as two fractured faces.

2.1.1.2 Slag

Slag shall be an air-cooled blast-furnace product having a dry unit weight of not less than 1045 kg/cubic meter (65 lbs per cubic feet).[AM#1]

2.1.2 Binder Material

Binder material shall consist of screenings, angular sand, or other finely divided mineral matter processed or naturally combined with the coarse aggregate. Liquid-limit and plasticity-index requirements shall apply to any component that is blended to meet the required gradation and shall also apply to the completed course. The portion of any component or of the completed course passing the 0.425 mm (No. 40)[AM#1] sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.1.3 Gradation

Requirements for gradation specified shall apply to the completed base course. The aggregates shall be continuously graded within the following limits:

Sieve Designation Square-Mesh Sieve*	Percentage by Weight Passing
1-3/4"	100
7/8"	65 - 90
3/8"	50 - 70
No. 4	35 - 55
No. 40	15 - 30

*The table is based on aggregates of uniform specific gravity and the percentages passing the various sieves are subject to appropriate corrections in accordance with ASTM C 127 and C 128 when aggregates of varying specific gravity are used. The gradation above conforms to Texas Department of Transportation Standard Specification for base course, Item 247, Type A, Grade 1. [AM#1] One gradation test will be performed every 2000 square yards or fraction thereof.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the base is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregates shall be obtained from off-site sources.

3.3 PREPARATION OF UNDERLYING COURSE

3.3.1 General Requirements

Before constructing aggregate base course, the previously constructed underlying course shall be cleaned of foreign substances. Surface of underlying course shall meet the specified compaction and surface tolerances. Subgrade shall conform to Section \=02225=\ EARTHWORK FOR ROADWAYS, RAILROADS, AND AIRFIELDS. Subbase course shall conform to Section \=02232=\ SELECT-MATERIAL SUBBASE COURSE. Ruts or soft, yielding spots that may appear in the underlying course, areas having inadequate compaction, and deviations of the surface from requirements specified shall be corrected. For cohesionless underlying materials containing sands, sand gravels, or any other cohesionless material in harmful quantities, the surface shall be mechanically stabilized with aggregate prior to placement of the aggregate course. Stabilization may be accomplished by mixing base course material into the underlying course and compacting by approved methods. Properly compacted material will be considered as part of the underlying course and shall meet all requirements for the underlying course. Finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until base course is placed.

3.3.2 Grade Control

Underlying material shall be excavated to sufficient depth for the required base course thickness so that the finished base course with the subsequent surface course will meet the fixed grade. Finished and completed area shall conform to the lines, grades, cross section, and dimensions indicated.

3.4 INSTALLATION

3.4.1 Mixing and Placing

Materials shall be mixed by the stationary plant, traveling plant, or road mix method and placed in such a manner as to obtain uniformity of the aggregate base course material and at a uniform optimum water content for

compaction. The Contractor shall make such adjustments in mixing or placing procedures or in equipment to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to ensure a satisfactory base course.

3.4.2 Edges of Base Course

Approved material shall be placed along edges of aggregate base course in such quantities as will compact to thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 300 mm width of the shoulder to be rolled and compacted simultaneously with rolling and compacting of each layer of base course.

3.4.3 Compaction

Each layer of aggregate base course including shoulders shall be compacted. Water content shall be maintained at optimum. Density of compacted mixture shall be at least 100 percent of laboratory maximum density. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. Areas inaccessible to the rollers shall be compacted with mechanical tampers, and shall be shaped and finished by hand methods.

3.4.4 Layer Thickness

Compacted thickness of the aggregate course shall be as indicated. No layer shall be in excess of 200 mm (8 inches)nor less than 75 mm (3 inches)[AM#1] in compacted thickness.

3.4.5 Proof Rolling

Proof rolling of the areas indicated shall be in addition to the compaction specified and shall consist of the application of 30 coverages with a heavy pneumatic-tired roller having four or more tires, each loaded to a minimum of 13,600 kg (15 tons) and inflated to a minimum of 1035 kPa (150 psi). In areas designated, proof rolling shall be applied to the top lift or layer on which base course is laid and to each layer of base course. Water content of the top lift or layer on which base course is laid shall be maintained at optimum or at percentage directed from start of compaction to completion of proof rolling of that layer. Water content of each layer of the base course shall be maintained at the optimum percentage directed from start of compaction to completion of proof rolling. Materials in base course or underlying materials that produce unsatisfactory results by rolling shall be removed and replaced with satisfactory materials and recompacted.

3.4.6 Finishing

The surface of the top layer shall be finished to grade and cross section shown. Finished surface shall be of uniform texture. Light blading during compaction may be necessary for the finished surface to conform to the lines, grades, and cross sections. Should the surface for any reason

become rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portion shall be scarified, reworked, recompacted, or replaced as directed.

3.4.6.1 Smoothness

Surface of each layer shall show no deviations in excess of 9.5 mm (3/8 inch) when tested with the 3.05 meter (10 foot)[AM#1} straightedge. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting, as directed.

3.4.6.2 Thickness Control

Compacted thickness of the base course shall be within 12.7 mm (½ inch) of the thickness indicated. Where the measured thickness is more than 12.7 mm (½ inch) deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 12.7 mm (½ inch) thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 6.4 mm of the thickness indicated.

3.5 FIELD QUALITY CONTROL

3.5.1 Field Density

Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When \-ASTM D 2922-\ is used, the calibration curves shall be checked, and adjusted if necessary, using the sand cone method as described in paragraph Calibration of the ASTM publication. \-ASTM D 2922-\ results in a wet unit weight of soil, and when using this method, \-ASTM D 3017-\ shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in \-ASTM D 3017-\. If \-ASTM D 2922-\ is used, in-place densities shall be checked by \-ASTM D 1556-\ at least once per lift for each 850 square meter of base material. Calibration curves and calibration test results shall be furnished within 24 hours of the conclusion of the tests. At least one field density test shall be performed for each 250 square meters of each layer of base material.

3.5.2 \+Smoothness+

Measurements for deviation from grade and cross section shown shall be taken in successive positions parallel to the road centerline with a 3 meter straightedge. Measurements shall also be taken perpendicular to the road centerline at 15 meter (50 foot)intervals.

3.5.3 \+Thickness+

Thickness of the base course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square meters (5400 square feet)[AM#1] of base course. Measurements shall be made in 75 mm (3 inch) diameter test holes penetrating the base course.

3.6 TRAFFIC

Completed portions of the area may be opened to traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.7 MAINTENANCE

The aggregate base course shall be maintained in a satisfactory condition until accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Removed in-place materials that are unsuitable for the base course material that is removed for the required correction of defective areas, and waste material and debris shall be disposed of as directed.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02511

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

01/89

PART
1 - GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

\-AASHTO M 182-\	(1991) Burlap Cloth Made from Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 185-\	(1990a) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
\-ASTM A 615-\	(1990) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
\-ASTM A 616-\	(1990) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
\-ASTM A 617-\	(1990) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
\-ASTM C 31-\	(1991) Making and Curing Concrete Test Specimens in the Field
\-ASTM C 143-\	(1990a) Slump of Hydraulic Cement Concrete
\-ASTM C 171-\	(1991) Sheet Materials for Curing Concrete
\-ASTM C 172-\	(1990) Sampling Freshly Mixed Concrete
\-ASTM C 173-\	(1978) Air Content of Freshly Mixed Concrete by the Volumetric Method
\-ASTM C 231-\	(1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
\-ASTM C 309-\	(1991) Liquid Membrane-Forming Compounds for Curing Concrete
\-ASTM D 1751-\	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

\-ASTM D 1752-\	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
\-ASTM D 3405-\	(1994) Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements

CORPS OF ENGINEERS (COE)

\-COE CRD-C 527-\	(1988) Standard Specification for Joint Sealants, Cold-Applied, Non-Jet-Fuel-Resistant, for Rigid and Flexible Pavements

1.2 SUBMITTALS

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

SD-09 Reports\

Field Quality Control\; *FIO*\.

Copies of all test reports within 24 hours of completion of the test.

SD-18 Records\

Concrete\; *FIO*\.

Copies of certified delivery tickets for all concrete used in the construction.

1.3 WEATHER LIMITATIONS

1.3.1 Placing During Cold Weather

Concrete placement shall be discontinued when the air temperature reaches 40 degrees F and is falling. Placement may begin when the air temperature reaches 35 degrees F and is rising. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement shall be approved in writing. Approval shall be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F. Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed [AM#1] 90 degrees F.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

1.4.2 Slip Form Equipment

Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in one pass.

PART 2 - PRODUCTS

2.1 *CONCRETE*\

Concrete shall conform to the applicable requirements of Section \=03300=\ CONCRETE FOR BUILDING CONSTRUCTIONand Section \=02513=\ CONCRETE PAVEMENT FOR ROADS except as otherwise specified. Concrete shall have a minimum compressive strength of 3500 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

2.1.2 Slump

The concrete slump shall be 2 inches plus or minus 1 inch for hand placed concrete or 1 inch plus or minus 1/2 inch for slipformed concrete where determined in accordance with \-ASTM C 143-\.

2.1.3 Reinforcement Steel

Reinforcement bars shall conform to \-ASTM A 615-\, \-ASTM A 616-\, or \-ASTM A 617-\. Wire mesh reinforcement shall conform to \-ASTM A 185-\.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to \-ASTM C 171-\, type optional, except that polyethylene film, if used, shall be white opaque.

2.2.2 Burlap

Burlap shall conform to \-AASHTO M 182-\.

2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to \-ASTM C 309-\, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

2.4.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

2.4.2 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to \-ASTM D 1751-\ or \-ASTM D 1752-\, 3/8 inch thick, unless otherwise indicated.

2.5 JOINT SEALANTS

2.5.1 Joint Sealant, Cold-Applied

Joint sealant, cold-applied shall conform to \-COE CRD-C 527-\.

2.5.2 Joint Sealant, Hot-Poured

Joint sealant, hot-poured shall conform to \-ASTM D 3405-\.

2.6 FORM WORK

Form work shall be designed and constructed to insure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2-inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10

feet. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

2.6.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 10 feet or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 1-1/2 inch benders, for the full height of the curb, cleated together.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted to conform with applicable requirements of Section \=02225=\ EARTHWORK.

3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms. [AM#1] <u>One density test shall be performed for every 600 square feet or fraction thereof.</u>

3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement. [AM#1] <u>One density test shall be performed every 150 linear feet of aggregate base course under curb and gutter.</u>

3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when

concrete is placed. The subgrade shall be prepared and protected so as to produce a subgrade free from frost when the concrete is deposited.

3.2 FORM SETTING

Forms shall be carefully set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of three stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10-foot long section. After forms are set, grade and alignment shall be checked with a 10-foot straightedge. Forms shall have a transverse slope of 1/4-inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer of such thickness that when consolidated and finished the sidewalks will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a wood float, bull float, or darby, edged and broom finished.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic.

3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

3.3.4 \+Surface and Thickness Tolerances+\

Finished surfaces shall not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators.

3.4.2 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 1/2 inch. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

3.4.3 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

3.4.4 \+Surface and Thickness Tolerances+\

Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 10 feet or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed at 40

intervals or less. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

3.5.1 Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8-inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.5.2 Expansion Joints

Expansion joints shall be formed with 1/2 inch joint filler strips. Joint filler shall be placed with top edge 1/4 inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer. Joints shall be sealed as specified in Section \=02580=\ JOINT SEALING IN CONCRETE PAVEMENTS FOR ROADS.

The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.5.3 Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 5 feet nor greater than 15 feet in length. Contraction joints shall be constructed by means of 1/8-inch thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as

practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

3.6.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 1/2 inch in width shall be provided at intervals not exceeding 45 feet. Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Joints shall be sealed as specified in Section \=02580=\ JOINT SEALING IN CONCRETE PAVEMENTS FOR ROADS AND AIRFIELDS.

Expansion joints and the top 1-inch depth of curb and gutter contraction-joints shall be sealed with joint sealer. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.7 CURING AND PROTECTION

3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.7.1.1 Mat Method

The entire exposed surface shall be covered with two or more layers of burlap. Mats shall overlap each other at least 6 inches. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.7.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. The curing medium shall not be less than 18-inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a

bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

3.7.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet per gallon for both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints.

Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.7.4 Protective Coating

Protective coating of linseed oil mixture shall be applied to the exposed-to-view concrete surface.

3.7.4.1 Application

Curing and backfilling operation shall be completed prior to applying protective coating. Concrete shall be surface dry and thoroughly clean before each application. Coverage shall be not more than 50 square yards per gallon for first application and not more than 70 square yards per gallon for second application, except that the number of applications and coverage for each application for commercially prepared mixture shall be in accordance with the manufacturer's instructions. Coated surfaces shall be protected from vehicular and pedestrian traffic until dry.

3.7.4.2 Precautions

Protective coating shall not be heated by direct application of flame or electrical heaters and shall be protected from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Material shall not be applied at temperatures lower than 50 degrees F.

3.8 *FIELD QUALITY CONTROL*\

3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.8.2 Concrete Testing

3.8.2.1 \+Strength Testing+\

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 250 cubic yards of concrete. The samples for strength tests shall be taken in accordance with \-ASTM C 172-\. Cylinders for acceptance shall be molded in conformance with \-ASTM C 31-\ by an approved testing laboratory. Each strength test result shall be the average of two test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

3.8.2.2 \+Air Content+

Air content shall be determined in accordance with \-ASTM C 173-\ or \-ASTM C 231-\. \-ASTM C 231-\ shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.8.2.3 \+Slump Test+

Two slump tests shall be made on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Additional tests will be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noticed along the edges of slip-formed concrete.

3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.9 SURFACE DEFICIENCIES AND CORRECTIONS

3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 1/4 inch. All pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02516

CONCRETE PAVEMENT

PART
1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 184-\	(1990) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
\-ASTM A 185-\	(1990a) Steel Welded Wire Fabric, Plain.
\-ASTM A 497-\	(1990b) Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
\-ASTM A 615-\	(1992b) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
\-ASTM A 616-\	(1992) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
\-ASTM A 617-\	(1992) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.
\-ASTM D 1751-\	(1983; R 1991) Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
\-ASTM D 1752-\	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
\-ASTM D 2828-\	(1971; R 1981) Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type.

CORPS OF ENGINEERS (COE)

\-COE CRD-C 572-\	(1974) Polyvinylchloride Water Stop.

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 DESCRIPTIONS.

SD-09 Reports\

Concrete Strength and Other Tests\; *FIO*\.

The Contractor shall furnish concrete strength and other tests in accordance with the testing procedures specified in PART 3 paragraph CONTRACTOR QUALITY CONTROL.

PART 2 - PRODUCTS

2.1 GENERAL

Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, and water so proportioned and mixed as to produce a plastic workable mixture. The concrete mix , shall be designed to secure a minimum compressive strength of \~4,000 psi~\ in 28 days.The consistency of any mix shall be that required to produce a slump between \~3 and 4 inches~\. Entrained air content of exterior concrete shall be 5 percent by volume. Maximum water-cement ratio (w/c) for normal weight concrete shall be 0.50.

2.2 JOINT FILLER

2.2.1 For Expansion Joints

Filler shall be preformed materials conforming to \-ASTM D 1751-\ or \-ASTM D 1752-\.

2.2.2 For Contraction Joints

Sawable type contraction joint inserts shall conform to \-ASTM D 2828-\. Nonsawable contraction joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of \-ASTM D 2828-\, with the exception of Section 3.4, "Resistance to Sawing." PVC inserts shall conform to \-COE CRD-C 572-\.

2.3 DOWELS

Dowels shall be plain steel bars conforming to \-ASTM A 615-\, grade 40 or 60; \-ASTM A 616-\, grade 50 or 60; or \-ASTM A 617-\, grade 40 or 60.

2.4 TIE BARS

Tie bars shall be deformed steel bars conforming to \-ASTM A 615-\, \-ASTM A 616-\, or \-ASTM A 617-\, and of the sizes and dimensions indicated. Deformed rail steel bars and high-strength billet or axle steel bars, grade 60 or higher, shall not be used for bars that are bent and straightened during construction.

2.5 REINFORCEMENT

All reinforcement shall be free from loose flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete. Removal of thin powdery rust and tight rust is not required. However, reinforcing steel which is rusted to the extent that it does not conform to the required dimensions or mechanical properties shall not be used.

2.5.1 Bar mats shall conform to \-ASTM A 184-\. The bar members shall be billet, rail, or axle steel, Grade 60.

2.5.2 Welded steel wire fabric shall conform to \-ASTM A 185-\.

2.5.3 Welded deformed steel wire fabric shall conform to \-ASTM A 497-\.

PART 3 - EXECUTION

3.1 JOINTS

Joints shall conform to the details indicated and shall be perpendicular to the finished grade of the pavement. Transverse expansion and contraction joints shall be straight and continuous from edge to edge of the pavement.

3.1.1 Construction Joints

3.1.1.1 Longitudinal Construction Joints

Longitudinal construction joints between paving lanes shall be located as indicated. Dowels, keys or keys and tie bars shall be installed in the longitudinal construction joints or the edges shall be thickened as required and as indicated. When the concrete is placed using stationary forms, metal forms securely fastened to the concrete form shall be used to form the keyway in the plastic concrete. The dimensions of the keyway forms shall not vary more than plus or minus 1/8 inch from the dimensions indicated and shall not deviate more than plus or minus 1/4 inch from the mid-depth of the pavement. Longitudinal construction joints shall be edged and subsequently sawed to provide a groove at the top conforming to the details and dimensions indicated.

3.1.1.2 Transverse Construction Joints

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for 30 minutes or longer. Insofar as practicable, transverse construction joints shall be installed in the location of a planned joint. When concrete placement cannot be continued, the transverse construction joint may be installed within the slab unit but not less than 10 feet from a planned transverse joint. Transverse construction joints shall be doweled as shown. When the construction joint is located at planned transverse joints, one half of each dowel shall be painted and oiled to permit movement at the joint. These joints shall be edged and subsequently sawed to provide a groove at the top conforming to the details and dimensions indicated. When a construction joint is installed within a slab unit, the dowel bars shall not be painted or oiled, and no groove shall be provided at the joint. When concrete placing is resumed, the planned joint spacing shall be used beginning with the first regularly scheduled transverse joint.

3.1.2 Expansion Joints

Expansion joints shall be formed by means of preformed filler material. The filler shall be securely held in position by means of approved metal supports which shall remain in the pavement. A removable metal channel cap bar shall be used to hold the parts of the joint in proper position

and protect the filler from damage during concreting operations. The cap bar shall be removable without damage to the pavement to provide a space for sealing of the joint. Adjacent sections of filler shall be fitted tightly together and the filler shall extend across the full width of the paving lane in order to prevent entrance of concrete into the expansion space. Expansion joints shall be formed about structures and features that project through, into, or against the pavement, using joint filler of the type, thickness, and width indicated, and installed in such manner as to form a complete, uniform separation between the structure and pavement.

3.1.3 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type, and shall be constructed as indicated. Longitudinal contraction joints shall be constructed by sawing a groove in the hardened concrete with a power-driven saw in conformance with paragraph "Sawed Joints" below, unless otherwise approved. Transverse contraction joints shall be constructed in conformance with requirements for sawed joints or insert-type joints, unless otherwise approved.

3.1.3.1 Sawed Joints

Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the full depth as indicated. After expiration of the curing period, the upper portion of the groove shall be widened by sawing to the width and depth indicated. The time of sawing shall be varied, depending on existing and anticipated weather conditions, and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The sawed faces of joints will be inspected for undercutting or washing of the concrete due to the early sawing, and sawing shall be delayed if undercutting is sufficiently deep to cause structural weakness or excessive roughness in the joint. The sawing operation shall be carried on as required during both day and night regardless of weather conditions. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. A chalk line or other suitable guide shall be used to mark the alinement of the joint. The saw cut shall not vary more than ½ inch from the true joint alinement. Before sawing a joint, the concrete shall be examined closely for cracks, and the joints shall not be sawed if a crack has occurred near the joint location. Sawing shall be discontinued when a crack develops ahead of the saw cut. Workmen and inspectors shall wear clean, rubber-soled footwear, and the number of persons walking on the pavement shall be limited to those actually performing the sawing operation. Immediately after joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. Any membrane-cured surface damaged during the sawing operations shall be resprayed as soon as the surface becomes dry. The sawing equipment shall be adequate in number of units and power to complete the sawing at the required rate. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operation.

3.1.3.2 Insert-Type Contraction Joints

Insert type contraction joints shall be constructed by installation of a preformed insert in the plastic concrete to form a weakened plane to induce cracking. The insert materials shall conform to \-ASTM D 2828-\, or \-CRD-C 572-\, whichever is applicable. Inserts shall be constructed so that the insert material can be removed to form a groove in the concrete as required. All types of inserts shall be approved prior to installation. Inserts shall be furnished in heights for the various depths of joints shown and in lengths equal to the width of the paving lane.

3.1.3.2.1 Equipment

Equipment for installing inserts shall be a machine equipped with a vibratory bar for cutting a groove in the plastic concrete for placement of the insert or for vibrating the insert into place at the prescribed joint location. Installation of the insert shall be to the required depth throughout the full width of the paving lane. The vibration units shall be so arranged that the vibration will be uniformly distributed throughout the bar. The intensity of vibration shall be adjustable as necessary to form a groove of proper size for the filler or forcing the insert into the plastic concrete and for consolidating the concrete around the in-place insert. The vibratory float shall be used following the placement of the insert material in lieu of hand floating or troweling the finish.

3.1.3.2.2 Installation of Inserts

The insert shall be installed in the plastic concrete immediately following the final machine finishing with a maximum of two joint spacings between finishing machine and inserter. Additional straightedge and texturing operations shall be accomplished without disturbing the installed insert. Adjacent sections of the joint inserts within each slab unit shall be securely joined together and the insert shall extend across the full width of the slab. The concrete shall be thoroughly consolidated against and for the full depth of the insert. The insert shall be perpendicular to the finished grade of the pavement and shall be straight in alinement at the prescribed joint locations shown, with the top of the inset flush or not more than 1/8 inch below the pavement surface. The insert equipment shall be available on the job in good condition prior to placement of concrete to insure proper vibration and floating.

3.1.3.2.3 Grooving Operations

After the expiration of the curing period a groove for joint sealer shall be formed as specified below. The top portion of fiberboard fillers or sawable preformed inserts shall be removed by sawing with a power saw to form a groove of required dimensions. The sawing shall be so accomplished as to abrade the concrete surfaces in the joint groove and remove all traces of the filler or insert. Nonsawable insert material shall be removed as prescribed by the manufacturer. The dimensions and characteristics of the groove thus formed shall be as shown on the plans. The grooves shall have edges free of ravels and spalls. The grooves shall be straight from edge to edge of the pavement and shall not vary more than ½ inch from alinement.

3.1.4 Sealing Joints

Joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit, as directed. Sawing of filler-type joints shall be accomplished immediately before sealing of the joints.

3.1.5 Grooving and Sealing Cracks

Random cracks, except those specifically excluded by the Contracting Officer, that occur in the pavement during construction shall be grooved and sealed. The top of the crack shall be grooved to a depth of 3/4 inch and to a width not less than 3/8 inch nor more than 5/8 inch by means of an approved mechanical grooving machine. The grooving tool shall be capable of following closely the path of the crack and of widening the top of the crack to the required section without spalling or otherwise damaging the concrete. Loose and fractured concrete shall be removed, and the groove shall be thoroughly cleaned and completely filled with approved joint sealing material of the type required for the area in which the crack occurs. No separate payment will be made for grooving, cleaning, and sealing of cracks.

3.2 FINISH FOR PAVEMENT

The pavement shall be struck off to grade and immediately straightedged with a 10-foot straightedge in both directions. Floating shall be started after the surface has been straightedged and all the surface water has disappeared. The initial floating may be performed by use of power-driven equipment. The final surface texture of the pavement shall be provided by means of a burlap drag, or broom as approved.

3.2.1 Burlap-Drag Texture

Surface texture shall be applied by dragging the surface of the pavement, in the direction of the concrete placement, with an approved multiple-ply burlap drag at least three feet in width and equal in length to the width of slab. The leading transverse edge of the drag shall be securely fastened to a lightweight pole or traveling bridge, and at least 12 inches of the burlap shall be in contact with the pavement during dragging operation. The drag shall be operated with the burlap moist and the burlap shall be cleaned and changed as required. The dragging shall be done so as to produce a uniform finished surface having a fine sandy texture without disfiguring marks.

3.2.2 Broom Texturing

Surface texture shall be applied using an approved hand or mechanical stiff bristle broom of a type that will produce uniform corrugations. For hand brooming, the brooms shall have handles longer than half the width of slab to be finished. The hand brooms shall be drawn transversely across the surface from the centerline to each edge with slight overlapping strokes. For mechanical operations, the broom shall be operated with the length of the broom parallel to the pavement centerline. The broom shall be capable of traversing the full width of the pavement in a single pass at a uniform speed and with a uniform pressure. Successive passes of the broom shall be overlapped the minimum necessary to obtain a uniformly textured surface. Brooms shall be washed thoroughly and dried at frequent intervals during use. Worn or damaged brooms shall be removed from the job site. Brooming should be completed before the concrete has

dried to the point where the surface will be unduly torn or roughened, but after drying has progressed enough so that the mortar will not flow and attenuate the sharpness of the corrugations. The corrugations should be uniform in appearance and approximately 1/16 inch in depth but not more than 1/8 inch in depth.

3.3 SURFACE TEST

After the concrete curing period, the surface of the paving shall be tested with a straightedge or device which shall be operated in such manner as to reveal any irregularities. Any portion of the pavement which shows a variation or departure greater than 1/8 inch from the testing edge of a 10-foot straightedge, shall be removed and replaced or corrected as directed by the Contracting Officer.

3.4 CURING AND PROTECTION

Concrete surfaces not covered by forms shall be protected against moisture loss for not less than 7 days by covering with burlap, cotton, or other approved fabric mats or sand, all kept continually wet by covering surfaces with waterproof paper with edges and ends lapped and sealed or by membrane-forming curing compound. Where formed surfaces are cured in the forms, the forms shall be kept continually wet. If forms are removed before the end of the curing period, curing shall be continued as on unformed surfaces using suitable materials.

The Contractor shall protect the pavement against all damage prior to final acceptance of the work by the Government. Traffic shall be excluded from the pavement until the concrete is at least 14 days old, or for a longer period if so directed by the Contracting Officer.

3.5 PAVEMENT THICKNESS

The pavement shall be constructed in accordance with the thickness shown on the drawings. No variation in thickness of over 1/4 inch will be permitted. If a variation in thickness occurs and, in the opinion of the Contracting Officer, is sufficient to seriously impair the service expected from the pavement, the deficient area shall be removed and replaced with a slab of quality and thickness satisfactory to the Contracting Officer. The Contracting Officer may allow the Contractor the choice of leaving the defective section in place and receiving no compensation or payment for same, or of removing and replacing the pavement as provided above.

3.6 SPECIMENS FOR STRENGTH TEST

A minimum of one set of 3 cylinders shall be made for every 100 cubic yards or less of concrete placed daily. [AM#1]

3.7 AIR CONTENT

A minimum of two tests for air content shall be made from randomly selected batches of concrete, for each 100 cubic yards or fraction thereof, of concrete placed during each 8 hour shift.

3.8 SLUMP

A minimum of two tests for slump shall be made from randomly selected batches of concrete, for each 100 cubic yards or fraction thereof, of concrete placed during each 8 hour shift.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02526 - WHEEL STOPS

PART 1 - GENERAL

1.1 REFERENCES (Not Applicable)

1.2 SUBMITTALS

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

SD-01, Data\

Wheel Stops\; *FIO*\.

Furnish manufacturer's catalog data and drawings describing proposed molded thermoplastic wheel stops to be installed on the project.

SD-13, Certificates\

Wheel Stops\; *FIO*\.

Furnish manufacturer's written certification that wheel stops furnished for the project conform to the specified requirements.

PART 2 - PRODUCTS

2.1 WHEEL STOPS

Wheel stops shall be constructed of precast reinforced concrete. [AM#1]

2.1.1 Concrete Wheel Stops

Concrete wheel stops shall be constructed of reinforced concrete having a compressive strength of 3,000 p.s.i. and conforming to the Section \=03300=\ CONCRETE FOR BUILDING CONSTRUCTION. The stops shall be constructed as detailed on the drawings, or may be approved manufactured items. If approved manufactured stops are used, installation shall be as recommended by the manufacturer and as approved.

2.1.2 Deleted. [AM#1]

PART 3 - EXECUTION

3.1 INSTALLATION

Wheel stops shall be installed as indicated and in the locations shown on the drawings. Stops will be inspected before installation and any damaged or defective stops shall be replaced.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02551

BITUMINOUS PAVING FOR ROADS, STREETS, AND PARKING AREAS

PART
1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 29-\	(1991a) Unit Weight and Voids in Aggregate
\-ASTM C 88-\	(1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
\-ASTM C 117-\	(1990) Materials Finer than 75-micrometer (No 200) Sieve in Mineral Aggregates by Washing
\-ASTM C 127-\	(1988) Specific Gravity and Absorption of Coarse Aggregate
\-ASTM C 128-\	(1988) Specific Gravity and Absorption of Fine Aggregate
\-ASTM C 131-\	(1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
\-ASTM C 136-\	(1984a) Sieve Analysis of Fine and Coarse Aggregates
\-ASTM C 183-\	(1988) Sampling and the Amount of Testing of Hydraulic Cement
\-ASTM D 5-\	(1986) Penetration of Bituminous Materials
\-ASTM D 75-\	(1987) Sampling Aggregates
\-ASTM D 140-\	(1988) Sampling Bituminous Materials
\-ASTM D 242-\	(1985; R 1990) Mineral Filler for Bituminous Paving Mixtures
\-ASTM D 422-\	(1963; R 1990) Particle-Size Analysis of Soils
\-ASTM D 946-\	(1982) Penetration-Graded Asphalt Cement for Use in Pavement Construction
\-ASTM D 1250-\	(1980; R 1990) Petroleum Measurement Tables

\-ASTM D 1856-\	(1979; R 1984) Recovery of Asphalt from Solution by Abson Method
\-ASTM D 2041-\	(1991) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
\-ASTM D 2172-\	(1992) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
\-ASTM D 2216-\	(1990) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
\-ASTM D 3381-\	(1983) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
\-ASTM D 3515-\	(1989) Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
\-ASTM D 4791-\	(1989) Flat or Elongated Particles in Coarse Aggregate

TEXAS STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION STANDARD SPECIFICATIONS: (TSDHPT)

TSDHPT-01	(1993) Standard Specification for Construction of Highways, Streets and Bridges

CORPS OF ENGINEERS (COE) HANDBOOK FOR CONCRETE AND CEMENT

COE CRD-C 649-95	Standard Test Method for Unit Weight, Marshall Stability, and Flow of Bituminous Mixtures
COE CRD-C 650-95	Standard Test Method for Density and Percent Voids in Compacted Bituminous Paving Mixtures
COE CRD-C 652-92	Standard Test Method for Measurement of Reduction in Marshall Stability of Bituminous Mixtures Caused by Immersion in Water

1.2 DELETED [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 \=01300=\ SUBMITTAL PROCEDURES:

SD-09 Reports\

Bituminous Pavement\; *GA*\.

Copies of test results.

SD-14 Samples\

Bituminous Pavement\; *GA*\.

Samples of the materials in the quantities indicated below for the job mix formula.

Aggregate and mineral filler (if needed) to be blended in approximately the same proportions as used in the project	100 kg
Asphalt Cement	20 liters

Aggregate samples when new sources are developed, with a plan for operation, 45 days before starting production. Samples of the asphalt cement specified, not less than 45 days before production.

SD-18 Records\

Waybills and Delivery Tickets\; *GA*\.

Waybills and delivery tickets, during progress of the work.

1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.4.1 General

The bituminous plant shall be of such capacity to produce the quantities of bituminous mixtures required. Hauling equipment, paving machines, rollers, miscellaneous equipment, and tools shall be provided in sufficient numbers and capacity and in proper working condition to place the bituminous paving mixtures at a rate equal to the plant output.

1.4.2 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 3.66 m (12-foot) straightedge for each bituminous paver. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.5 WEATHER LIMITATIONS

Unless otherwise directed, bituminous courses shall not be constructed when temperature of the surface of the existing pavement or base course is below 5 degrees C.

1.6 PROTECTION OF PAVEMENT

After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until the pavement has cooled to 60 degrees C.

1.7 GRADE AND SURFACE-SMOOTHNESS REQUIREMENTS

Finished surface of bituminous courses, when tested as specified below and in paragraph ACCEPTABILITY OF WORK, shall conform to gradeline and elevations shown and to surface-smoothness requirements specified.

1.7.1 Plan Grade

The grade of the completed surface shall not deviate more than 15.2 mm (0.05 foot) from the plan grade.

1.7.2 Surface Smoothness

When a 3.66 m (12-foot) straightedge is laid on the surface parallel with the centerline of the paved area or transverse from crown to pavement edge, the surface shall vary not more than 6.4 mm (1/4 inch) from the straightedge.

1.8 GRADE CONTROL

Lines and grades shall be established and maintained by means of line and grade stakes placed at site of work in accordance with the SPECIAL CLAUSES. Elevations of bench marks used by the Contractor for controlling pavement operations at the site of work will be determined, established, and maintained by the Government. Finished pavement elevations shall be established and controlled at the site of work by the Contractor in accordance with bench mark elevations furnished by the Contracting Officer.

1.9 SAMPLING AND TESTING

Except as otherwise specified herein in paragraph: ACCEPTABILITY OF WORK, sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Unless otherwise specified, sampling shall be in accordance with ASTM D 75 for aggregates, ASTM C 183 for mineral filler, and ASTM D 140 for bituminous material. Copies of test results shall be furnished to the Contracting Officer. Approval of a source does not relieve the Contractor of responsibility for delivery at the job site of materials meeting the requirements herein.

1.9.1 Tests Required

1.9.1.1 Plant Mix

1.9.1.1.1 Hot Bin Gradations

Hot bin gradations (cold-feed gradation when drum mix plant is used) shall be tested in accordance with ASTM C 136 and ASTM C 117. A minimum of one test will be conducted per every 200 tons of wearing course mix placed or fraction thereof, and a minimum of one test conducted per every 350 tons of intermediate course mix placed or fraction thereof.

1.9.1.1.2 Marshall Specimens

Marshall Specimens shall be taken in accordance with CRD-C 652-95. At least one set of specimens shall be taken per each 200 tons of wearing course mix placed, and one set of specimens shall be taken per each 350 tons of intermediate course mix placed. However, not less than two sets of specimens (three specimens per set) shall be taken in any one day regardless of the quantity of mix placed.

1.9.1.1.3 Asphalt Extractions

Asphalt extractions shall be performed in accordance with ASTM D 2172, Method A or B. At least one asphalt extraction shall be conducted per [AM#1] 200 tons of wearing course and once per 350 tons of intermediate course.

1.9.1.2 Field Density Tests

Field Density Test shall be conducted in accordance with CRD-C 650-95. A minimum of one test will be conducted per every 200 tons of wearing course mix placed or fraction thereof, and a minimum of one test conducted per every 350 tons of intermediate course mix placed or fraction thereof. [AM#1] (3 specimens per test, 2 mats and 1 joint density.)

1.9.1.3 Thickness Measurements

Thickness measurements shall be taken at a minimum of one measurement for each 835 square meters of mix placed.

1.10 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.10.1 Mineral Aggregates

Mineral aggregates shall be delivered to the site of the bituminous mixing plant and stockpiled in such manner as to preclude fracturing of aggregate particles, segregation, contamination, or intermingling of different materials in the stockpiles or cold-feed hoppers. Mineral filler shall be delivered, stored, and introduced into the mixing plant in a manner to preclude exposure to moisture or other detrimental conditions.

1.10.2 Bituminous Materials

Bituminous materials shall be maintained at appropriate temperature during storage but shall not be heated by application of direct flame to walls of storage tanks or transfer lines. Storage tanks, transfer lines, and weigh buckets shall be thoroughly cleaned before a different type or grade of bitumen is introduced into the system. The asphalt cement shall be heated sufficiently to allow satisfactory pumping of the material; however, the storage temperature shall be maintained below 150 degrees C.

1.11 ACCESS TO PLANT AND EQUIPMENT

The Contracting Officer shall have access at all times to all parts of the paving plant for checking adequacy of the equipment in use; inspecting operation of the plant; verifying weights, proportions, and character of

materials; and checking temperatures maintained in preparation of the mixtures.

1.12 *WAYBILLS AND DELIVERY TICKETS*

Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified waybills and certified delivery tickets for all aggregates and bituminous materials actually used in construction.

PART 2 - PRODUCTS

2.1 HOT-MIX SURFACE COURSE

Bituminous hot-mix surface course shall conform to the requirements of TSDHPT-01 for "Hot-Mix Asphaltic Concrete Pavement," Item 340, except as specified hereinafter.

2.1.1 Asphalt Material

Asphalt material for the surface course shall be asphalt cement AC-20 conforming to TSDHPT-01 for "Asphalts, Oils, and Emulsions," Item 300. Asphalt material shall come from a source approved for use by the TSDHPT. The seal number from the tank and the number of the TSDHPT Laboratory test report shall be furnished to the Contracting Officer.

2.1.2 Paving Mixture

Paving mixture shall be Type "D".

2.1.3 State Specification Modifications

TSDHPT Specification shall be modified as follows:

(a) Material retained on the 2mm size sieve shall not exceed 65 percent.

(b) Density and stability requirements shall not apply.

© Construction methods paragraph shall not apply.

(d) The measurement and payment paragraphs shall not apply.

2.2 PROPORTIONING OF MIXTURE

2.2.1 Job Mix Formula (JMF)

The JMF for the bituminous mixture shall be furnished to the Contracting Officer for approval. No payments will be made for mixtures produced prior to the approval of the JMF. The formula will indicate the percentage of each stockpiled and mineral filler, the percentage of each size aggregate, the percentage of bitumen, and the temperature of the completed mixture when discharged from the mixer. The tolerances specified in TSDHPT-01 "Item 340", will be allowed for asphalt content, temperature, and aggregate grading for tests conducted on the mix as discharged from the mixing plant; however, the final evaluation of aggregate gradation and asphalt content will be based on PART 3 paragraph

ACCEPTABILITY OF WORK. Bituminous mix that deviates more than 4 degrees C. from the JMF shall be rejected. The JMF may be adjusted during construction to improve paving mixtures, as directed, without adjustments in contract prices.

2.2.2 Test Properties of Bituminous Mixtures

Finished mixture shall meet the requirements described below when tested in accordance with CRD-C 649-95. All samples will be compacted with 50 blows of specified hammer on each side of sample. When bituminous mixture fails to meet the requirements specified below, the paving operation shall be stopped until cause of noncompliance is determined and corrected.

2.2.2.1 Stability, Flow, and Voids

Requirements for stability, flow, and voids are shown in TABLES I and II for nonabsorptive and absorptive aggregates, respectively.

TABLE I. NONABSORPTIVE-AGGREGATE MIXTURE

	Wearing Course	Intermediate Course
Stability minimum, Newtons	2200	2200
Flow maximum, 25/100-millimeter units	20	20
Voids total mix, percent (1)	3-5	4-6
Voids filled with bitumen, percent (2)	75-85	65-75

(1) The Contracting Officer may permit deviations from limits specified when gyratory method of design is used to develop the JMF.

(2) The contracting Officer may permit deviation from limits specified for voids filled with bitumen in the intermediate course in order to stay within limits for percent voids total mix.

TABLE II. ABSORPTIVE-AGGREGATE MIXTURE

	Wearing Course	Intermediate Course
Stability minimum, Newtons	2200	2200
Flow maximum, 25/100-millimeter units	20	20
Voids total mix, percent (1)	2-4	3-5
Voids filled with bitumen, percent (2)	80-90	70-80

(1) The Contracting Officer may permit deviations from limits specified when gyratory method of design is used to develop the JMF.

(2) The Contracting Officer may permit deviation from limits specified for voids filled with bitumen in the intermediate course in order to stay within limits for percent voids total mix.

a. When the water-absorption value of the entire blend of aggregate does not exceed 2.5 percent as determined in accordance with ASTM C 127 and ASTM C 128, the aggregate is designated as nonabsorptive. The

theoretical specific gravity computed from the apparent specific gravity or ASTM D 2041 will be used in computing voids total mix and voids filled with bitumen, and the mixture shall meet requirements in TABLE I.

b. When the water-absorption value of the entire blend of aggregate exceeds 2.5 percent as determined in accordance with ASTM C 127 and ASTM C 128, the aggregate is designated as absorptive. The theoretical specific gravity computed from ASTM D 2041 shall be used in computing percentages of voids total mix and voids filled with bitumen; the mixture shall meet requirements in TABLE II.

2.2.2.2 Stability

The index of retained stability must be greater than 75 percent as determined by CRD-C 652-95. When the index of retained stability is less than 75, the aggregate stripping tendencies may be countered by the use of hydrated lime or by treating the bitumen with an approved antistripping agent. The hydrated lime is considered as mineral filler and should be considered in the gradation requirements. The amount of hydrated lime or antistripping agent added to bitumen shall be sufficient, as approved, to produce an index of retained stability of not less than 75 percent. No additional payment will be made to the Contractor for addition of antistripping agent required.

PART 3 - EXECUTION

3.1 BASE COURSE CONDITIONING

The surface of the base course will be inspected for adequate compaction and surface tolerances specified in Section 02241 AGGREGATE BASE COURSE. Unsatisfactory areas shall be corrected.

3.2 PREPARATION OF BITUMINOUS MIXTURES

Rates of feed of aggregates shall be regulated so that the moisture content and temperature of aggregates will be within specified tolerances. Aggregates, mineral filler, and bitumen shall be conveyed into the mixer in proportionate quantities required to meet the JMF. Mixing time shall be as required to obtain a uniform coating of the aggregate with the bituminous material. Temperature of bitumen at time of mixing shall not exceed 150 degrees C. Temperature of aggregate and mineral filler in the mixer shall not exceed 160 degrees C when bitumen is added. Overheated and carbonized mixtures or mixtures that foam shall not be used.

3.3 WATER CONTENT OF AGGREGATES

Drying operations shall reduce the water content of mixture to less than 0.75 percent. The water content test will be conducted in accordance with \-ASTM D 2216-\; the weight of the sample shall be at least 500 grams. If the water content is determined on hot bin samples, the water content will be a weighted average based on composition of blend.

3.4 STORAGE OF BITUMINOUS PAVING MIXTURE

Storage shall conform to the applicable requirements of \-ASTM D 3515-\; however, in no case shall the mixture be stored for more than 4 hours.

3.5 TRANSPORTATION OF BITUMINOUS MIXTURE

Transportation from paving plant to site shall be in trucks having tight, clean, smooth beds lightly coated with an approved releasing agent to prevent adhesion of the mixture to the truck bodies. Excessive releasing agent shall be drained prior to loading. Each load shall be covered with canvas or other approved material of ample size to protect mixture from weather and to prevent loss of heat. Loads that have crusts of cold, unworkable material or that have become wet will be rejected. Hauling over freshly placed material will not be permitted.

3.6 SURFACE PREPARATION OF UNDERLYING COURSE

Prior to placing of the intermediate or wearing course, the underlying course shall be cleaned of all foreign or objectionable matter with power brooms and hand brooms.

3.7 PRIME COATING

Surfaces of previously constructed base course shall be sprayed with a coat of bituminous material conforming to Section \=02558=\ BITUMINOUS TACK AND PRIME COAT.

3.8 TACK COATING

Contact surfaces of previously constructed pavement, curbs, manholes, and other structures shall be sprayed with a thin coat of bituminous material conforming to Section \=02558=\ BITUMINOUS TACK AND PRIME COAT.

3.9 PLACING

Bituminous courses shall be constructed only when the base course or existing pavement has no free water on the surface. Bituminous mixtures shall not be placed without ample time to complete spreading and rolling during daylight hours, unless approved satisfactory artificial lighting is provided.

3.9.1 Offsetting Joints

The wearing course shall be placed so that longitudinal joints of the wearing course will be offset from joints in the intermediate course by at least 300 mm. Transverse joints in the wearing course shall be offset by at least 600 mm from transverse joints in the intermediate course.

3.9.2 General Requirements for Use of Mechanical Spreader

Range of temperatures of mixtures, when dumped into the mechanical spreader, shall be as determined by the Contracting Officer. Mixtures having temperatures less than 110 degrees C when dumped into the mechanical spreader shall not be used. The mechanical spreader shall be adjusted and the speed regulated so that the surface of the course being laid will be smooth and continuous without tears and pulls, and of such depth that, when compacted, the surface will conform to the cross section indicated. Placing with respect to center line areas with crowned sections or high side of areas with one-way slope shall be as directed. Each lot of material placed shall conform to requirements specified in

paragraph ACCEPTABILITY OF WORK. Placing of the mixture shall be as nearly continuous as possible, and speed of placing shall be adjusted, as directed, to permit proper rolling. When segregation occurs in the mixture during placing, the spreading operation shall be suspended until the cause is determined and corrected.

3.9.3 Placing Strips Succeeding Initial Strips

In placing each succeeding strip after initial strip has been spread and compacted as specified below, the screed of the mechanical spreader shall overlap the previously placed strip 50 to 75 mm and be sufficiently high so that compaction produces a smooth dense joint. Mixture placed on the edge of a previously placed strip by the mechanical spreader shall be pushed back to the edge of the strip by use of a lute. Excess mixture shall be removed and wasted.

3.9.4 Handspreading in Lieu of Machine Spreading

In areas where the use of machine spreading is impractical, the mixture shall be spread by hand. Spreading shall be in a manner to prevent segregation. The mixture shall be spread uniformly with hot rakes in a loose layer of thickness that, when compacted, will conform to required grade, density, and thickness.

3.10 \+COMPACTION OF MIXTURE+\

Rolling shall begin as soon after placing as the mixture will bear a roller without undue displacement. Delays in rolling freshly spread mixture will not be permitted. After initial rolling, preliminary tests of crown, grade, and smoothness shall be made by the Contractor. Deficiencies shall be corrected so that the finished course will conform to requirements for grade and smoothness specified herein. Crown, grade, and smoothness will be checked in each lot of completed pavement by the Contracting Officer for compliance and will be evaluated as specified in paragraph ACCEPTABILITY OF WORK. After the Contractor is assured of meeting crown, grade, and smoothness requirements, rolling shall be continued until a mat density of 97.0 to 100.0 percent and a joint density of 95.0 to 100.0 percent of density of laboratory-compacted specimens of the same mixture is obtained. The density will be determined and evaluated as specified in paragraph ACCEPTABILITY OF WORK. Places inaccessible to rollers shall be thoroughly compacted with hot hand tampers.

3.10.1 Testing of Mixture

At the start of the plant operation, a quantity of mixture shall be prepared that is sufficient to construct a test section at least 15 m long, two spreader widths wide and of thickness to be used in the project. Mixture shall be placed, spread, and rolled with equipment to be used in the project and in accordance with the requirements specified above. This test section shall be tested and evaluated as a lot and shall conform to all specified requirements. If test results are satisfactory, the test section shall remain in place as part of the completed pavement. If tests indicate that the pavement does not conform to specification requirements, necessary adjustments to plant operations and rolling procedures shall be made immediately, and test section will be evaluated as specified in paragraph ACCEPTABILITY OF WORK. Additional test sections, as directed,

shall be constructed and sampled for conformance to specification requirements. In no case shall the Contractor start full production of an intermediate or wearing course mixture without approval.

3.10.2 Correcting Deficient Areas

Mixtures that become contaminated or are defective shall be removed to the full thickness of the course. Edges of the area to be removed shall be cut so that sides are perpendicular and parallel to the direction of traffic and so that the edges are vertical. Edges shall be sprayed with bituminous materials conforming to Section \=02558=\ BITUMINOUS TACK AND PRIME COAT. Fresh paving mixture shall be placed in the excavated areas in sufficient quantity so that the finished surface will conform to grade and smoothness requirements. Paving mixture shall be compacted to the density specified herein. Skin patching of an area that has been rolled shall not be permitted.

3.11 JOINTS

3.11.1 General

Joints between old and new pavements, between successive work days, or joints that have become cold (less than 80 degrees C) shall be __[AM#1] <u>sawed back</u> to insure continuous bond between the old and new sections of the course. All joints shall have the same texture and smoothness as other sections of the course. Contact surfaces of previously constructed pavements coated by dust, sand, or other objectionable material shall be cleaned by brushing or shall be cut back as directed. When directed by the Contracting Officer, the surface against which new material is placed shall be sprayed with a thin, uniform coat of bituminous material conforming to Section \=02558=\ BITUMINOUS TACK AND PRIME COAT. Material shall be applied far enough in advance of placement of a fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

3.11.2 Transverse Joints

The roller shall pass over the unprotected end of a strip of freshly placed material only when placing is discontinued or delivery of the mixture is interrupted to the extent that the material in place may become cold. In all cases, prior to continuing placement, the edge of previously placed pavement shall be cut back to expose an even vertical surface for full thickness of the course. In continuing placement of a strip, the mechanical spreader shall be positioned on the transverse joint so that sufficient hot mixture will be spread to obtain a joint after rolling that conforms to the required density and smoothness specified herein.

3.11.3 Longitudinal Joints

Edges of a previously placed strip shall be prepared such that the pavement in and immediately adjacent to the joint between this strip and the succeeding strip meets the requirements for grade, smoothness, and density specified in paragraph ACCEPTABILITY OF WORK.

[AM#1]
3.12 DELETED.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02556

ASPHALTIC BITUMINOUS HEAVY-DUTY PAVEMENT (CENTRAL-PLANT HOT MIX)

06/91

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 29-\	(1991a) Unit Weight and Voids in Aggregate
\-ASTM C 88-\	(1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
\-ASTM C 117-\	(1990) Materials Finer than 75-micrometer (No. 200) Sieve in Mineral Aggregates by Washing
\-ASTM C 127-\	(1988; R 1993) Specific Gravity and Absorption of Coarse Aggregate
\-ASTM C 128-\	(1993) Specific Gravity and Absorption of Fine Aggregate
\-ASTM C 131-\	(1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
\-ASTM C 136-\	(1993) Sieve Analysis of Fine and Coarse Aggregates
\-ASTM C 183-\	(1988) Sampling and the Amount of Testing of Hydraulic Cement
\-ASTM D 5-\	(1986) Penetration of Bituminous Materials
\-ASTM D 75-\	(1987; R 1992) Sampling Aggregates
\-ASTM D 140-\	(1993) Sampling Bituminous Materials
\-ASTM D 242-\	(1985; R 1990) Mineral Filler for Bituminous Paving Mixtures
\-ASTM D 946-\	(1982; R 1993) Penetration-Graded Asphalt Cement for Use in Pavement Construction
\-ASTM D 1250-\	(1980; R 1990) Petroleum Measurement Tables

\-ASTM D 1856-\	(1979; R 1984) Recovery of Asphalt from Solution by Abson Method
\-ASTM D 2041-\	(1991) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
\-ASTM D 2172-\	(1993) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
\-ASTM D 2216-\	(1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
\-ASTM D 3381-\	(1992) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
\-ASTM D 3515-\	(1989) Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
\-ASTM D 4791-\	(1989) Flat or Elongated Particles in Coarse Aggregate

1.2 NOTIFICATION

On projects involving a quantity of bituminous mixture of 2,000 tons or more, the Contractor shall notify the Contracting Officer at least five working days in advance of beginning the pavement placement so that the Corps of Engineers Division Office (CESWD-ED-G and CESWD-CO-C) may have representatives at the site.

1.3 GRADE CONTROL

Lines and grades shown on contract drawings for each pavement category of contract shall be established and maintained by means of line and grade stakes placed at site of work by the Contractor in accordance with the SPECIAL CLAUSES. Elevations of bench marks used by the Contractor for controlling pavement operations at the site of work will be determined, established, and maintained by the Government. Finished pavement elevations shown shall be established and controlled at the site of work by the Contractor in accordance with bench mark elevations furnished by the Contracting Officer.

1.4 SUBMITTALS

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

SD-09 Reports\

Test Results\; *FIO*\.

Job Mix Formula and testing for development of Job Mix formula. Material samples to the Materials Testing Center, Waterways Experiment Station for Quality Assurance Tests.

Contractor Quality Control test results.

SD-18 Records\

Waybills and Delivery Tickets\; *FIO*\.

Waybills and delivery tickets shall be submitted to the Contracting Officer during progress of the work."

1.5 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.5.1 Storage of Bituminous Paving Mixture

Storage of bituminous paving mixture shall conform to the applicable requirements of \-ASTM D 3515-\; however, in no case shall the mixture be stored for more than 4 hours.

1.5.2 Transportation of Bituminous Mixture

Transportation from the paving plant to the site shall be in trucks having tight, clean, smooth beds lightly coated with an approved releasing agent to prevent adhesion of mixture to truck bodies. Excessive releasing agent shall be drained prior to loading. Each load shall be covered with canvas or other approved material of ample size to protect mixture from weather and to prevent loss of heat. Loads that have crusts of cold, unworkable material or have become wet by rain will be rejected. Hauling over freshly placed material will not be permitted.

1.5.3 Waybills and Delivery Tickets

Waybills and delivery tickets shall be submitted to the Contracting Officer during progress of the work. Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified waybills and certified delivery tickets for all aggregates and bituminous materials actually used in the construction and covered by the contract.

1.5.4 Mineral Aggregates

Mineral aggregates shall be delivered to the site of the bituminous mixing plant and stockpiled in such manner as to preclude fracturing of aggregate particles, segregation, contamination, or intermingling of different materials in the stockpiles or cold-feed hoppers. Mineral filler shall be delivered, stored, and introduced into the mixing plant in a manner to preclude exposure to moisture or other detrimental conditions.

1.5.5 Bituminous Materials

Bituminous materials shall be maintained at appropriate temperature during storage but shall not be heated by application of direct flame to walls of storage tanks or transfer lines. Storage tanks, transfer lines, and weigh bucket shall be thoroughly cleaned before a different type or grade of bitumen is introduced into the system. The asphalt cement shall be heated sufficiently to allow satisfactory pumping of the material; however, the storage temperature shall be maintained below 150 degrees C.

1.6 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.6.1 General

The bituminous plant shall be of such capacity, as specified herein to produce the quantities of bituminous mixtures required for the project. Hauling equipment, paving machines, rollers, miscellaneous equipment, and tools shall be provided in sufficient numbers and capacity and in proper working condition to place the bituminous paving mixtures at a rate equal to the plant output.

1.6.2 Mixing Plants

1.6.2.1 General

The mixing plant shall be an automatic or semiautomatic controlled, commercially manufactured unit designed and operated to consistently produce a mixture within the tolerances specified for the job-mix formula (JMF). The plant shall have a minimum capacity of 100 tons per hour.

1.6.2.2 Drum Mixer

Drum mixers shall be prequalified at the production rate to be used during actual mix production. The prequalification tests will include extraction and recovery of the asphalt cement in accordance with \-ASTM D 2172-\ and \-ASTM D 1856-\. The penetration of the recovered asphalt binder shall not be less than 60 percent of the original penetration, as measured in accordance with \-ASTM D 5-\.

1.6.3 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 12 foot straightedge for each bituminous paver. Straightedge shall be made available for Government use. Straightedge shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to ensure rigidity and accuracy. Straightedge shall have handles to facilitate movement on pavement.

1.7 ACCESS TO PLANT AND EQUIPMENT

The Contracting Officer shall have access at all times to all parts of the paving plant for checking adequacy of equipment in use; inspecting operation of plant; verifying weights, proportions, and character of materials; and checking temperatures maintained in preparation of mixtures.

1.8 SAMPLING AND TESTING

1.8.1 General

Sampling and testing of materials and material sources shall be the responsibility of the Contractor; except that the Government will perform such tests as required for verification of materials, material sources, and contractor developed Job Mix Formula (JMF), as well as tests specified in paragraph "ACCEPTANCE TESTING" hereinafter. Quality Control Sampling and testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Samples of materials and the Contractor developed job mix formula shall be submitted for quality

assurance studies by the Government in accordance with paragraph 1.10.2. Approval does not relieve the Contractor of responsibility for delivery at the job site of materials meeting the requirements herein. Contractor Quality Control Testing and Inspection during construction shall conform to Paragraph: TESTS.

1.8.2 Samples for Quality Assurance Studies

At least 45 days in advance of the beginning of paving operations, the Contractor developed Job Mix Formula (JMF), material samples, and material test results, including supporting data including individual as well as combined grading curves of aggregates shall be delivered to the Materials Testing Center, Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, Mississippi, 39180-6199, by the Contractor at the Contractor's expense. Studies based on the Contract Specifications using the Contractor's submitted materials and JMF will be made by and at the expense of the Government. Samples of approved aggregates and mineral filler shall be taken under the supervision of the Contracting Officer in accordance with \-ASTM D 75-\ and \-ASTM C 183-\, accompanied by test reports indicating conformance with the grading requirements specified. Samples of materials other than aggregates shall be representative of those proposed for the project and shall be submitted accompanied by the manufacturer's test report indicating compliance with applicable specified requirements. Quantities of materials shall be as follows:

MATERIAL	SAMPLE SIZE
Asphalt	1 GAL
Fine Aggregate	100 lbs. of each
Coarse Aggregate	400 lbs. of each
Additives....	
1. Filler material if required by Specifications	25 lbs.
2. Other	As directed by the Contracting Officer
Petrographic and Gradation only...	
1. Fine Aggregate	100 lbs. of each
2. Coarse Aggregate	100 lbs. of each"

PART 2 - PRODUCTS

2.1 AGGREGATES

Aggregates shall consist of natural sand, crushed stone, crushed gravel, crushed slag, screenings, sand, and mineral filler, as required. The portion of materials retained on the No. 4 sieve shall be known as coarse aggregate; the portion passing the No. 4 sieve and retained on the No. 200

sieve as fine aggregate; and the portion passing the No. 200 sieve as mineral filler. Aggregate gradation shall conform to gradation(s) specified in TABLE I. TABLE I is based on aggregates of uniform specific gravity; the percentage passing various sieves may be changed by the Contracting Officer when aggregates of varying specific gravities are used. Adjustments of percentages passing various sieves may be directed by the Contracting Officer when aggregates vary more than 0.2 in specific gravity.

TABLE I - AGGREGATE GRADATION WEARING COURSE

3/4-in. Maximum

Sieve Size	(Percent by Weight Passing)
1 inch	
3/4 inch	100
1/2 inch	82-96
3/8 inch	75-89
NO. 4	59-73
NO. 8	46-60
NO. 16	34-48
NO. 30	24-38
NO. 50	15-27
NO. 100	8-18
NO. 200	3-~

2.1.1 Coarse Aggregate

Coarse aggregate shall consist of clean, sound, durable particles meeting the following requirements:

a. Percentage of loss shall not exceed 40 percent after 500 revolutions, as determined in accordance with \-ASTM C 131-\.

b. Percentage of loss shall not exceed 18 after five cycles performed in accordance with \-ASTM C 88-\, using magnesium sulfate.

c. Not used.

d. Crushed gravel retained on the No. 4 sieve and each coarser sieve listed in TABLE I shall contain at least 75 percent by weight of crushed pieces having two or more fractured faces with the area of each face equal to at least 75 percent of the smallest midsectional area of piece. When two fractures are contiguous, the angle between planes of fractures shall be at least 30 degrees to count as two fractured faces.

e. Particle shape of crushed aggregates shall be essentially cubical. Quantity of flat and elongated particles in any sieve size shall not exceed 20 percent by weight, when determined in accordance with \-ASTM D 4791-\.

2.1.2 Fine Aggregates

Fine aggregate shall consist of clean, sound, durable, angular particles produced by crushing stone, slag, or gravel that meets requirements for

wear and soundness specified for coarse aggregate. Fine aggregates produced by crushing gravel shall have at least 90 percent by weight of crushed particles having two or more fractured faces in the portion retained on the No. 30 sieve. This requirement shall apply to material before blending with natural sand, when blending is necessary. Quantity of natural sand to be added to the wearing-and intermediate-course mixtures shall not exceed 15 percent by weight of coarse and fine aggregate and material passing the No. 200 sieve. Natural sand shall be clean and free from clay and organic matter. Percentage of loss shall not exceed 15 after five cycles of the soundness test performed in accordance with \-ASTM C 88-\, using magnesium sulfate.

2.1.3 Mineral Filler

Mineral filler shall conform to \-ASTM D 242-\.

2.2 BITUMINOUS MATERIALS

Asphalt cement shall conform to \-ASTM D 3381-\, Grade AC-20.

2.3 ADDITIVES

The use of additives such as antistripping and antifoaming agents is subject to approval.

2.4 BITUMINOUS HOT MIX

Bituminous hot mix shall consist of coarse aggregate, fine aggregate, mineral filler, bituminous material, and approved additives, if required, of the qualities and in the proportions specified and shall conform to requirements contained in paragraphs PROPORTIONING OF MIXTURE and ACCEPTABILITY OF WORK.

2.5 PROPORTIONING OF MIXTURE

2.5.1 Job Mix Formula

The JMF for the bituminous mixture shall be furnished to the Contracting Officer by the Contractor. No payment will be made for mixtures produced prior to approval of the JMF. The formula will indicate the percentage of each stockpile and mineral filler, (as based on samples furnished) the percentage passing each sieve size, the percentage of bitumen, and the amount of antistripping agent, if needed. Tolerances are given in TABLE II for asphalt content, temperature, and aggregate grading for tests conducted on the mix as discharged from the mixing plant; however, the final evaluation of aggregate gradation and asphalt content will be based on paragraph ACCEPTABILITY OF WORK. Bituminous mix that deviates more than 25 degrees F from JMF shall be rejected. The JMF may be adjusted during construction to improve paving mixtures, as directed, without adjustments in the contract unit prices. Tolerances shown may permit the aggregate gradation to be outside of the band specified in Table I; this will be acceptable.

TABLE II JOB-MIX TOLERANCES

Tolerance,

Material	Plus or Minus
Aggregate passing No. 4 or larger sieves	4 percent
Aggregate passing Nos. 8, 16, 30, and 50 sieves	3 percent
Aggregate passing Nos. 100 and 200 sieves	1 percent
Bitumen	0.20 percent
Temperature of mixing	25 degrees F

2.5.2 \+Test Properties of Bituminous Mixtures+

Finished mixture shall meet requirements described below when tested in accordance with CRD-C 649-95, CRD-C 650-95, and ASTM D 1559. All samples will be compacted with 75 blows of specified hand-held hammer on each side of sample (or mechanical equipment providing compaction equivalent to a hand-held hammer.) When bituminous mixture fails to meet the requirements specified below, the paving operation shall be stopped until the cause of noncompliance is determined and corrected.

2.5.3 Stability, Flow and Voids

Requirements for stability, flow, and voids are shown in TABLES III and IV for nonabsorptive and absorptive aggregates, respectively.

TABLE III NONABSORPTIVE-AGGREGATE MIXTURE (1)

Stability minimum, pounds	1800
Flow maximum, 1/100-inch units	16
Voids total mix, percent (1)	3-5
Voids filled with bitumen, percent	70-80

(1) The Contracting Officer may permit deviations from limits specified for voids filled with bitumen in the intermediate course in order to stay within limits for percent voids total mix.

TABLE IV ABSORPTIVE-AGGREGATE MIXTURE (1)

Stability minimum, pounds	1800
Flow maximum, 1/100-inch units units	16
Voids total mix, percent (1)	2-4
Voids filled with bitumen, percent	75-85

The Contracting Officer may permit deviations from limits specified for voids filled with bitumen in the intermediate course in order to stay within the limits for percent voids total mix.

2.5.3.1 Nonabsorptive Aggregate

When the water-absorption value of the entire blend of aggregate does not exceed 2.5 percent, as determined in accordance with \-ASTM C 127-\ and \-ASTM C 128-\, the aggregate is designated as nonabsorptive. The theoretical specific gravity computed from the apparent specific gravity or \-ASTM D 2041-\ will be used in computing voids total mix and voids filled with bitumen, and the mixture shall meet the requirements in TABLE III.

2.5.3.2 Absorptive Aggregate

When the water-absorption value of the entire blend of aggregate exceeds 2.5 percent as determined in accordance with \-ASTM C 127-\ and \-ASTM C 128-\, the aggregate is designated as absorptive. The theoretical specific gravity computed from the bulk-impregnated specific gravity method contained in \-ASTM D 2041-\ shall be used in computing percentages of voids total mix and voids filled with bitumen; the mixture shall meet requirements in TABLE IV.

2.5.3.3 Antistripping Agent

The index of retained stability shall be greater than 75 percent as determined by CRD-C 652-95. When the index of retained stability is 75 percent or less, aggregate stripping tendencies shall be countered by the use of hydrated lime or by treating the bitumen with an approved antistripping agent. The hydrated lime will be considered as mineral filler and will be considered in the gradation requirements. The amount of hydrated lime or antistripping agent added to bitumen will be determined during development of the Job Mix Formula, and will be sufficient, to produce an index of retained stability greater than 75 percent. Use of additional antistripping agent may be directed during progress of the work, if necessary. No additional payment will be made to the Contractor for addition of antistripping agent required.

[AM#1]
2.5.3.4 At the contractors option, the aggregates and asphaltic materials shall conform to the requirements of the Texas Department of Transportation, Standard Specifications for Construction of Highways, Streets and Bridges, Items 300 and 340. The paving mixture shall conform to the requirements for type “D” grading. Asphaltic material for the paving mixture shall be asphaltic cement, viscosity grade AC-20.

PART 3 - EXECUTION

3.1 WEATHER LIMITATIONS

Bituminous courses shall not be constructed when the temperature of the surface of the existing pavement or base course is below 40 degrees F.

3.2 BASE COURSE CONDITIONING

Surface of the base course will be inspected for adequate compaction and surface tolerances specified in Section 02241 AGGREGATE BASE COURSE. Unsatisfactory areas shall be corrected.

3.3 SURFACE PREPARATION OF UNDERLYING COURSE

Prior to the placing of intermediate or wearing course, the underlying course shall be cleaned of all dust and other foreign or objectionable matter with power brooms and hand brooms.

3.4 PREPARATION OF BITUMINOUS MIXTURES

Rates of feed of aggregates shall be regulated so that moisture content and temperature of aggregates will be within specified tolerances. Aggregates, mineral filler, and bitumen shall be conveyed into the mixer in proportionate quantities required to meet the JMF. Mixing time shall be as required to obtain a uniform coating of the aggregate with the bituminous material. Temperature of bitumen at the time of mixing shall not exceed 300 degrees F. Temperature of aggregate and mineral filler in the mixer shall not exceed 325 degrees F when bitumen is added. Overheated and carbonized mixtures or mixtures that foam shall not be used.

3.5 \+WATER CONTENT OF AGGREGATES+\

Drying operations shall reduce the water content of mixture to less than 0.75 percent. Water content test will be conducted in accordance with \-ASTM D 2216-\; weight of sample will be at least 500 grams. If water content is determined on hot bin samples, the water content will be a weighted average based on the composition of the blend.

3.6 PRIME COATING

Surface of previously constructed base course shall be sprayed with a coat of bituminous material conforming to Section \=02558=\ BITUMINOUS PRIME AND TACK COAT.

3.7 TACK COATING

Contact surfaces of previously constructed pavement, curbs, manholes, and other structures to be contacted by the bituminous mat shall be sprayed with a thin coat of bituminous material conforming to Section \=02558=\ BITUMINOUS PRIME AND TACK COAT.

3.8 PLACING

Bituminous courses shall be constructed only when the base course or existing pavement has no free water on the surface. Bituminous mixtures shall not be placed without ample time to complete spreading and rolling during daylight hours, unless approved satisfactory artificial lighting is provided.

3.8.1 Joints in Succeeding Course

Longitudinal joints that occur at runway and taxiway centerlines shall be constructed so that the joint in each course is located 12 inches from the centerline with the joint in each succeeding course alternating from one side of the centerline to the other. Other longitudinal joints shall be constructed so that the joint in each succeeding course is offset at least 12 inches from the previous one. Transverse joints in each course shall be constructed so that they are offset by at least 2 feet from a joint in any lower course. All joints in every course shall have neat, dense vertical faces; wedge type joints will not be permitted, except for transverse joints at the end of a leveling course, where approved. Where this is not attained otherwise, sawing will be required. Where drawings do not exactly define thickness or extent of a leveling or intermediate course, the Contractor shall assure that the depth and extent is controlled so that no overlaying course will be placed at less than the thickness indicated, and in no case less than 1-1/2 inches.

3.8.2 General Requirements for Use of Mechanical Spreader

The temperature of the bituminous mixture when dumped into the hopper of the paver (mechanical spreader) shall be between 250 and 270 degrees F. If less than 250 degrees F, the mixture shall be wasted. The mechanical spreader shall be adjusted and the speed regulated so that the surface of the course being laid will be smooth and continuous without tears and pulls, and of such depth that, when compacted, the surface will conform to the cross section indicated. Placing centerline areas with crowned sections or high side of areas with one-way slope shall be as directed. Each lot of material placed shall conform to requirements specified in paragraph ACCEPTABILITY OF WORK. Placing of the mixture shall be as nearly continuous as possible, and the speed of placing shall be adjusted, as directed, to permit proper rolling. When segregation occurs in the mixture during placing, the spreading operation shall be suspended until the cause is determined and corrected.

3.8.3 Placing Strips Succeeding Initial Strips

In placing each succeeding strip after the initial strip has been spread and compacted as specified below, the screed of the mechanical spreader shall overlap the previously placed strip 2 to 3 inches and be sufficiently high so that subsequent compaction produces a smooth dense joint. Mixture placed on the edge of a previously placed strip by the mechanical spreader shall be pushed back to the edge of the strip by the use of a lute. Excess material shall be removed and wasted.

3.8.4 Handspreading in Lieu of Machine Spreading

In isolated areas where use of machine spreading is impractical, the mixture shall be spread by hand. Spreading shall be in a manner to prevent segregation. The mixture shall be spread uniformly with hot rakes in a loose layer of thickness that, when compacted, will conform to the required grade, density, and thickness.

3.9 JOINTS

3.9.1 General

Joints between old and new pavements, between successive days' work, or joints that have become cold (less than 175 degrees F) because of any delay, shall be __[AM#1] sawed back to ensure continuous bond between the old and new sections of the course. All joints shall have the same texture and smoothness as other sections of the course. Contact surfaces of previously constructed pavements coated by dust, sand, or other objectionable material shall be cleaned by brushing or shall be cut back as directed. When directed by the Contracting Officer, the surface against which new material is placed shall be sprayed with a thin, uniform coat of bituminous material conforming to Section \=02558=\ BITUMINOUS PRIME AND TACK COAT. Material shall be applied far enough in advance of the placement of fresh mixture to ensure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

3.9.2 Transverse Joint

The roller shall pass over the unprotected end of a strip of freshly placed material only when the placing is discontinued or the delivery of the mixture is interrupted to the extent that material in place may become cold. In all cases, prior to continuing placement, the edge of previously placed pavement shall be cut back by sawing full depth to expose an even vertical surface for full thickness of the course. In continuing placement of the strip, the mechanical spreader shall be positioned on the transverse joint so that sufficient hot mixture will be spread to obtain a joint after rolling that conforms to the required density and smoothness specified herein.

3.9.3 Longitudinal Joints

Edges of a previously placed strip shall be prepared such that the pavement in and immediately adjacent to the joint between this strip and the succeeding strip meets the requirements for grade, smoothness, and density as described in paragraph ACCEPTABILITY OF WORK.

3.10 COMPACTION OF MIXTURE

Rolling shall begin as soon after placing as the mixture will bear a roller without undue displacement. Delays in rolling freshly spread mixture will not be permitted. After initial rolling, preliminary tests of crown, grade, and smoothness shall be made by the Contractor. Deficiencies shall be corrected so that the finished course will conform to requirements for grade and smoothness specified herein. Crown, grade, and smoothness will be checked for compliance in each lot of completed pavement by the Contracting Officer and will be evaluated as specified in paragraph ACCEPTABILITY OF WORK. After the crown, grade, and smoothness requirements have been met, rolling shall be continued until a mat density of __[AM#1] 97.0 to 100.0 percent and a joint density of at least 96.5 percent of density of laboratory-compacted specimens of the same mixture are obtained. The density will be determined and evaluated as specified in paragraph PERCENT PAYMENT. Places inaccessible to rollers shall be thoroughly compacted with hot hand tampers.

3.10.1 \+Testing of Mixture+\

At the start of the plant operation, a quantity of mixture shall be prepared sufficient to construct a test section at least 15 meters long,

two spreader widths wide and of thickness to be used in the project. Mixture shall be placed, spread, and rolled with the equipment to be used in the project and in accordance with requirements specified above. This test section will be tested and evaluated as a lot and shall conform to all specification requirements. If approved by the Contracting Officer, the test section may be located in one of the less critical areas of the project pavement construction. Otherwise, it shall be located outside the project paving. If tests results are satisfactory, the test section shall remain in the place as part of the completed pavement if constructed in the project pavement area. If tests indicate that the pavement does not conform to specification requirements, the test section shall be removed and the material disposed of off-site. Necessary adjustments to the plant operations and rolling procedures shall be made immediately, and another test section constructed, all at no additional cost to the Government. Other additional test sections, as necessary and as directed, shall be constructed and will be sampled and tested for conformance with specification requirements. In no case shall the Contractor start full production of an intermediate or wearing course mixture without approval.

3.10.2 Correcting Deficient Areas

Mixtures that become contaminated or are defective shall be removed to the full thickness of the course. Edges of the area to be removed shall be cut so that the sides are perpendicular and parallel to the direction of traffic and so that the edges are vertical. Edges shall be sprayed with bituminous materials conforming to Section \=02558=\ BITUMINOUS PRIME AND TACK COAT. Fresh paving mixture shall be placed in the excavated areas in sufficient quantity so that the finished surface when compacted will conform to the grade and smoothness requirements. Paving mixture shall be compacted to the density specified herein. Skin patching or feather edging of an area that has been rolled shall not be permitted.

3.11 PROTECTION OF PAVEMENT

After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until the pavement has cooled to 140 degrees F.

3.12 TESTS [AM#1]

The extent and frequency of testing and inspection shall be sufficient to assure that all materials, operations, and finished products meet all requirements of these specifications and at least consist of the following minimum amount. All testing shall be performed by an approved commercial testing laboratory, unless the Contractor has an in-house testing laboratory which has been inspected and approved by the Contracting Officer. The methods used for sampling and testing shall be the same as those specified for Government quality assurance testing. Reports shall be prepared of all testing and inspection and shall be submitted within 24 hours of the time sampling or testing took place. Minimum acceptable extent of testing and inspection shall be as follows:

a. Gradation test shall be made on samples of aggregate from the cold feed, at least one for every 250 tons of each size of aggregate, and more often and at other locations as necessary to maintain uniformity of production.

b. Quality and gradation tests shall be made on samples of aggregate as it is delivered to the site, at least one for every 2500 tons of each size of aggregate.

c. Marshall Specimens shall be taken in accordance with CRD-C 652-95. At least one set of specimens shall be taken per each 200 tons of wearing course mix placed, and one set of specimens shall be taken per each 350 tons of intermediate course mix placed. However, not less than two sets of specimens (three specimens per set) shall be taken in any one day regardless of the quantity of mix placed.

d. Asphalt extractions shall be performed in accordance with ASTM D 2172, Method A or B. At least one asphalt extraction shall be conducted per day. 200 tons of wearing course and once per 350 tons of intermediate course.

e. Field Density Test shall be conducted in accordance with CRD-C 650-95. A minimum of one test will be conducted per every 200 tons of wearing course mix placed or fraction thereof, and a minimum of one test conducted per every 350 tons of intermediate course mix placed or fraction thereof. (3 specimens per test, 2 mats and 1 joint density.)

f. Thickness measurements shall be taken at a minimum of one measurement for each 835 square meters of mix placed.

g. Quality and gradation tests shall be made on samples of mineral filler as it is delivered to the site, at least one for every 250 tons of mineral filler, if material other than portland cement, lime, or fly ash is used as mineral filler.

h. Tests for asphalt content and Marshall tests (stability, flow, total voids, and voids filled) shall be made as directed, if Government acceptance testing shows there to be a problem with control.

i. Check and recalibrate scales, other measuring devices and batching or proportioning equipment at least once every 50 tons of bituminous mixture produced. Test grade as necessary to assure that specification requirements are attained.

j. Test surface smoothness as necessary to assure that specification requirements are attained.

k. Continuously check that all placing operations, including construction of joints, conform to all specification requirements. Report problems encountered.

3.13 ACCEPTABILITY OF WORK

3.13.1 General

Testing for acceptability of work will be performed by the Government.

3.13.2 Grade and Surface-Smoothness Requirements

Finished surface of pavements, when tested as specified below and in paragraph Grade shall conform to elevations shown and to the surface smoothness requirements specified.

3.13.2.1 Plan Grade Requirement

Finished surfaces shall conform within tolerances specified to the cross sections indicated. Finished surfaces shall vary not more than 0.05 foot on parking areas and road pavements from the plan elevation established and approved at site of work, in accordance with paragraph GRADE CONTROL. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. Grade will be determined and evaluated as specified in paragraph Grade.

3.13.2.2 Surface Smoothness Requirement

Except for grade changes, finished surfaces, both for lane interiors and across-joints, shall not deviate from the testing edge of a 12 foot straightedge more than tolerances shown for the respective pavement category in TABLE V. Surface smoothness shall be determined and evaluated as specified in paragraph Surface Smoothness. However, any pavement area having an abrupt offset of 1/8 inch, or more, in the intermediate, or wearing course, in either the lane interior, or at a joint, shall be rejected, and the affected area shall be removed and replaced as directed.

TABLE V. SURFACE-SMOOTHNESS TOLERANCES

Pavement Category	Direction of Testing	Tolerance for Intermediate Course, mm
Roads and Parking Areas	Longitudinal	1/8 inch
Roads and Parking Areas	Transverse	1/4 inch

3.14 PERCENT PAYMENT

Where appropriate, adjustment in payment for individual lots of bituminous mixture will be made in accordance with the following paragraphs. No such adjustment in payment will be made for bituminous material (asphalt cement). A lot will be that quantity of construction that will be evaluated for compliance with specification requirements. A lot will be equal to 8 hours production. In order to evaluate aggregate gradation,

asphalt content, and field density, each lot will be divided into four equal sublots. Grade and surface smoothness determinations will be made on the lot as a whole. For field density-determination, one random sample will be taken from the mat, and one random sample will be taken from the joint of each sublot. Each random sample will weigh at least 1250 grams. After air drying to a constant weight, random in-place samples (cores) obtained from the mat (interior of the lane) and from the joints will be used for field density determination using CRD - C 650-95 laboratory density tests of in-place samples taken from the pavement (cores). One sample for determining laboratory density, asphalt content, aggregate gradation will be taken from a loaded truck delivering mixture to each sublot or other appropriate location in the sublot. Asphalt content will be determined in accordance with \-ASTM D 2172-\, Method A or B. Gradation of the aggregate will be determined from the recovered aggregate according to \-ASTM C 136-\ and \-ASTM C 117-\. All samples will be deliberately selected to be truly random, not haphazard, using commonly recognized methods of assuring randomness, employing randomizing tables or computer programs.

3.14.1 Acceptance of Lots

When a lot of material fails to meet the specification requirements, that lot shall be removed and replaced or accepted at a reduced price. The lowest computed percent payment determined for any pavement characteristic (i.e., gradation, asphalt content, density, grade, and smoothness) discussed below shall be the actual percent payment for that lot. The actual percent payment is applied to the bid price and the quantity of bituminous mixture placed in the lot to determine actual payment.

3.14.2 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. Testing in these areas will be in addition to the lot testing, and the requirements for these areas will be the same as those for a lot.

3.14.3 Aggregate Gradation

The mean absolute deviation of the four sublot aggregate gradations from the JMF for each sieve size will be evaluated and compared with TABLE VI. The computed percent payment based on aggregate gradation will be the lowest value determined for any sieve size in TABLE VI. All tests for aggregate gradation will be completed and reported within 24 hours after completion of construction of each lot.

----------EXAMPLE OF COMPUTATIONS----------

The computation of mean absolute deviation for one sieve size and of the computed percent payment for aggregate gradation is illustrated below for typical series of gradation tests.

Assume the following JMF required gradation and test results for aggregate gradation on sublot samples:

. . . . . Percent by Weight Passing Sieves

Sieve Size	JMF	Test No. 1	Test No. 2	Test No. 3	Test No. 4
3/4 inch	100	100	100	100	100
1/2 inch	88	87	88	90	88
3/8 inch	75	72	77	78	74
No. 4	64	60	65	67	62
No. 8	53	50	56	57	52
No. 16	42	39	44	45	41
No. 30	32	30	34	35	32
No. 50	20	17	20	22	21
No. 100	10	8	10	10	11
No. 200	6	4	7	8	6

Mean Absolute Deviation (for NO. 200 Sieve)= ((absolute value of 4-6) + (absolute value of 7-6) + (absolute value of 8-6) + (absolute value of 6-6))/4 = (2+1+2+0)/4 = 1.25

The mean absolute deviation for other sieve sizes can be determined in a similar way for this example to be:

Sieve Size	3/4 inch	1/2 inch	3/8 inch	No. 4	No 8	No. 16	No. 30	No. 50	No. 100
Mean Absolute Deviation	0	0.75	2.25	2.50	2.75	2.25	1.75	1.50	0.75

Taking the mean absolute deviation as computed above for the No.200 sieve and the other 9 sieves, and going to Table VI, it is found that the lowest percent payment would be based on the results for the NO. 200 sieve. This percent payment is 98 and constitutes for this example the computed percent payment based on aggregate gradation.

----------END OF EXAMPLE----------

TABLE VI. PERCENT PAYMENT BASED ON MEAN ABSOLUTE DEVIATION OF AGGREGATE GRADATIONS FROM JMF

Sieve Size	Percent Payment Based On Mean Absolute Deviation from JMF						
	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	Above 6.0
3/4 inch	100	100	100	100	98	95	90
1/2 inch	100	100	100	100	98	95	90
3/8 inch	100	100	100	100	98	95	90
No. 4	100	100	100	100	98	95	90
No. 8	100	100	100	98	95	90	reject
No. 16	100	100	100	98	95	90	reject
No. 30	100	100	100	98	95	90	reject
No. 50	100	100	100	98	95	90	reject
No. 100	100	98	95	90	90	reject	reject
No. 200	100	98	90	reject	reject	reject	reject

3.14.4 Asphalt Content

The mean absolute deviation of the four asphalt contents (one from each sublot) from the JMF will be evaluated and compared with TABLE VII. The computed percent payment based on asphalt content will be the value determined in accordance with TABLE VII. All asphalt content tests will be completed and reported within 24 hours after completion of construction of each lot.

TABLE VII. PERCENT PAYMENT BASED ON ASPHALT CONTENT

Mean Absolute Deviation of Extracted Asphalt Content from JMF	Percent Payment
0.25 or less	100
0.26-0.35	98
0.36-0.40	95
0.41-0.45	90
Above 0.45	reject

3.14.5 Density Considerations

The average mat density and the average joint density will be expressed as a percentage of the average laboratory density for the lot. The laboratory density for each lot will be determined in accordance with MIL STD 620, Method 100 from four sets of laboratory samples. One sample will be obtained from loaded trucks delivering mixture to each of the four sublots or other appropriate location. These samples will be taken at the same time and location as the samples for aggregate gradation and asphalt content, but will be kept separate from them. Each sample will be divided into three subsamples to produce one set of three laboratory specimens for each sublot. Laboratory specimens will be prepared from asphalt mixture which has not been reheated in the laboratory. Specimens will be compacted in accordance with MIL STD 620within 2 hours of the time the mixture was loaded into trucks at the asphalt plant and before the temperature of the specimen has dropped to 250 degrees F. Insulated containers shall be used as necessary to maintain the temperature. In addition to determining laboratory density on all specimens; marshall stability, flow, total voids and voids filled, will also be determined for one specimen from each sublot.

3.14.5.1 Field Density

The average field densities for mat and for joints in the lot will be determined and compared with TABLE VIII and used to calculate the computed percent payment based on field density as described below. First, the percent payment deduction for both mat density and joint density will be computed by subtracting the percent payment values found in Table VIII from 100. Then, the weighted percent payment deduction for joint density will be computed by multiplying the percent payment deduction for joint density, as computed above, by the ratio of the total amount of bituminous mixture in the joint strip to the total amount of bituminous mixture in the entire mat in the lot. The area of the joint strip will be considered to be 10 feet wide times the length of completed (lanes on both sides of joint completed) longitudinal construction joint in the lot, but not to exceed the total lot size. The length of joint to be considered will be that length where a new lane has been placed against an adjacent lane of bituminous pavement, either an adjacent freshly paved lane or one paved at any time previously. The percent payment deduction for mat density and the weighted percent payment deduction for joint density will be compared and the greatest selected. This selected percent payment deduction will be subtracted from 100 to obtain the computed percent payment based on field density.

TABLE VIII. PERCENT PAYMENT BASED ON DENSITY

Average Mat Density (4 Cores)	Percent Payment	Average Joint Density (4 Cores)
98.0-100.0	100.0	Above 96.5
97.9	100.0	96.4
97.8, 100.1	99.9	96.3
97.7	99.8	96.2
97.6, 100.2	99.6	96.1
97.5	99.4	96.0
97.4, 100.3	99.1	95.9
97.3	98.7	95.8
97.2, 100.4	98.3	95.7
97.1	97.8	95.6
97.0, 100.5	97.3	95.5
96.9	96.3	95.4
96.8, 100.6	94.1	95.3
96.7	92.2	95.2
96.6, 100.7	90.3	95.1
96.5	87.9	95.0
96.4, 100.8	85.7	94.9
96.3	83.3	94.8
96.2, 100.9	80.6	94.7
96.1	78.0	94.6
96.0, 101.0	75.0	94.5
below 96.0, above 101.0	reject	below 94.5

----------EXAMPLE OF COMPUTATION----------

The calculation of computed percent payment based on field density is illustrated below for a typical set of field tests on the mat and on joints in a typical lot.

Assume the following test results for field density made on the lot:

Average Mat Density -- 97.2 percent (of lab density)
Average Joint Density -- 95.5 percent (of lab density)
Total Area of Lot -- 2800 sq. meter
Length of Completed Longitudinal Construction Joint -- 600 meters.
(Paving lane on each side of joint complete)

Step 1: Determine percent payment based on mat density and on joint density, using Table VIII:

Mat density of 97.2 percent = 98.3 percent payment

Joint density of 95.5 percent = 97.3 percent payment

Step 2: Determine percent payment deduction based on mat density and on joint density by subtracting each percent payment from 100:

Mat: 100 percent - 98.3 percent = 1.7 percent deduction

Joint: 100 percent - 97.3 percent = 2.7 percent deduction

Step 3: Determine ratio of joint strip area to mat area (total paved area in the lot): Multiply the length of completed longitudinal construction joint by the specified 3 meters. width and divide by the mat area (total paved area in the lot).

(600 meters x 3 meters)/2800 sq. meters = 0.643 ratio of joint strip area to mat area

Step 4: Determine the weighted percent payment deduction for joint density:

Multiply percent payment deduction for joint density by ratio of joint strip area to mat area

2.7 percent x 0.643 = 1/74 percent weighted percent payment deduction for joint density

Step 5: Compare weighted percent payment deduction for mat density and select the larger:

Percent payment deduction for mat density - 1.7 percent

Weighted percent payment deduction for joint density - 1.74 percent

Select the larger = 1.74 percent

Step 6: Determine computed percent payment based on field density by subtracting the larger value from Step 5 from 100:

100 - 1.74 percent = 98.2 percent computed percent payment based on field density

----------END OF EXAMPLE----------

3.14.5.2 Density Samples

All density results on a lot will be completed and reported within 24 hours after the construction of that lot. When the Contracting Officer considers it necessary to take additional samples for density measurements, sampling will be done in groups of four (one for each sublot). The percent payment shall be determined for each additional group of four samples and averaged with the percent payment for the original group to determine the final percent payment. The Contractor shall fill all sample holes with hot mix and compact.

3.14.6 Grade

The finished surface of the pavement will be tested for conformance with specified plan-grade requirements. The finished grade of each pavement area will be determined by running lines of levels at intervals of 25 feet or less longitudinally and transversely to determine the elevation of the completed pavement. The finished grade of each pavement area will be determined by running lines of level along the centerline and each edge at stations of 25 feet or less. Within 5 working days after the completion of placement of a particular lot, the Contracting Officer will inform the Contractor in writing of results of grade-conformance tests. When more than 5 percent of all measurements made within a lot are outside the specified tolerances, the computed percent payment for that lot will be 95 percent. In areas where the grade exceeds the plan-grade tolerances given in paragraph Grade and Surface-Smoothness Requirements by more than 50 percent, the Contracting Officer will require removal of the deficient area and replacement with fresh paving mixture. Sufficient material shall be removed to allow at least 1 inch of asphalt concrete to be placed. Skin patching for correcting low areas or planing or milling for correcting high areas shall not be permitted on the wearing course.

3.14.7 Surface Smoothness

After the completion of final rolling of a lot, the compacted surface will be tested by the Contracting Officer with a 12 foot straightedge. Measurements will be made perpendicular to and across all joints at equal distances along the joint not to exceed 25 feet. Location and deviation from straightedge for all measurements will be recorded. When more than 5 percent of all measurements along the joints or along the mat within a lot exceed the specified tolerance, the computed percent payment for that lot will be 95 percent. Any joint or mat area surface deviation which exceeds the surface-smoothness tolerances given in paragraph Grade and Surface-Smoothness Requirements by more than 50 percent shall be corrected to meet the specification requirements. The Contractor shall remove the deficient area and replace with fresh paving mixture at no additional cost to the Government. Sufficient material shall be removed to allow at least 25.4 mm of asphalt concrete to be placed. Skin patching for correcting low areas or planing or milling for correcting high areas shall not be permitted.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

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 PAYMENT

Payment for removing existing concrete pavement and bituminous pavement will be made at the contract price for PAVEMENT REMOVAL, which payment shall constitute full compensation for all plant, labor, tools, handling, hauling, disposal, and all other incidentals necessary to completely remove the pavement as shown on the drawings and as specified herein.

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.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02592A

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS

10/92

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 this text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 509-\	(1991) Elastomeric Cellular Preformed Gasket and Sealing Material
\-ASTM D 789-\	(1992) Determination of Relative Viscosity, Melting Point, and Moisture Content of Polyamide (PA)

FEDERAL SPECIFICATIONS (FS)

\-FS SS-S-200-\	(Rev E; Am 1) Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement
\-FS SS-S-1401-\	(Rev C; Am 1; Notice 1) Sealant, Joint, Non-Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Asphalt Concrete Pavements
\-FS SS-S-1614-\	(Rev A; Am 1; Notice 1) Sealants, Joint, Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Tar Concrete Pavements

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-06 Instructions\

Manufacturer's Recommendations\; *[FI0]*\.

Installation procedures in accordance with the manufacturer's recommendations,30 days prior to use on the project.

1.3 SAFETY

Joint sealant shall not be placed within 25 feet of any liquid oxygen (LOX) equipment, LOX storage, or LOX piping. Joints in this area shall be thoroughly cleaned and left unsealed.

1.4 EQUIPMENT

Machines, tools, and equipment used shall be as required by the sealant manufacturer.

1.5 DELETED.

1.6 DELIVERY AND STORAGE

Materials delivered to the job site shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall be provided at the job site for maintaining materials at the temperatures and conditions recommended by the manufacturer.

1.7 ENVIRONMENTAL CONDITIONS

The ambient air temperature and the pavement temperature within the joint wall shall be a minimum of 50 degrees F and rising at the time of application of the materials. Sealant shall not be applied if moisture is observed in the joint.

PART 2 - PRODUCTS

2.1 SEALANTS

Materials for sealing cracks in the various paved areas indicated on the drawings shall be FS SS-S-1401

2.2 PRIMERS

Primers shall be as recommended by the manufacturer of the sealant.

2.3 BACKUP MATERIALS

The backup material shall be a compressible, nonshrinking, nonstaining, nonabsorbing material and shall be nonreactive with the joint sealant. The material shall have a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with \-ASTM D 789-\. The material shall have a water absorption of not more than 5 percent of the sample weight when tested in accordance with \-ASTM C 509-\. The backup material shall be 25 plus or minus 5 percent larger in diameter than the nominal width of the crack.

2.4 BOND BREAKING TAPES

The bond breaking tape or separating material shall be a flexible, nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive-backed tape. The material shall have a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with \-ASTM D 789-\. The bond breaker tape shall be approximately 1/8-inch wider than the nominal width of the joint and shall not bond to the joint sealant.

PART 3 - EXECUTION

3.1 PREPARATION OF JOINTS

Immediately before the installation of the sealant, the joints shall be thoroughly cleaned to remove all laitance, curing compound, filler, protrusions of hardened concrete, and old sealant from the sides and upper edges of the joint space to be sealed.

3.1.1 Sawing

Sawing shall be done with a concrete saw that has the blade stiffened with dummy or used blades or washers. Sawing shall remove material until the joint is open to the full specified width and depth.

3.1.2 Back-Up Material

When the joint opening is of a greater depth than indicated for the sealant depth, the lower portion of the joint opening shall be plugged or sealed off using a back-up material to prevent the entrance of the sealant below the specified depth. Care shall be taken to ensure that the backup material is placed at the specified depth and is not stretched or twisted during installation.

3.1.3 Bond Breaking Tape

Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, a bond breaker separating tape will be inserted to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. The tape shall be securely bonded to the bottom of the joint opening so it will not float up into the new sealant.

3.1.4 Rate of Progress of Joint Preparation

The stages of joint preparation which include blast-cleaning, compressed air cleaning and placing of the back-up material shall be limited to only that lineal footage that can be sealed during the same day.

3.2 PREPARATION OF SEALANT

3.2.1 Hot-Poured Sealants

Sealants conforming to FS SS-S-1401 shall not be heated in excess of the safe heating temperature recommended by the manufacturer as shown on the sealant containers. Sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day's operation shall be withdrawn and wasted.

3.3 INSTALLATION OF SEALANT

3.3.1 Time of Application

Joints shall be sealed immediately following final cleaning of the joint walls and following the placement of the separating or backup material.

Open joints that cannot be sealed under the conditions specified, or when rain interrupts sealing operations shall be recleaned and allowed to dry prior to installing the sealant.

3.3.2 Sealing Joints

Immediately preceding, but not more than 50 feet ahead of the joint sealing operations, a final cleaning with compressed air shall be performed. The joints shall be filled from the bottom up to 5/16 inch plus or minus 1/16 inch below the pavement surface. Excess or spilled sealant shall be removed from the pavement by approved methods and shall be discarded. The sealant shall be installed in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. When a primer is recommended by the manufacturer, it shall be applied evenly to the joint faces in accordance with the manufacturer's instructions. Joints shall be checked frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

3.4 INSPECTION

3.4.1 Joint Cleaning

Joints shall be inspected during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Cleaned joints shall be approved prior to installation of the separating or back-up material and joint sealant.

3.4.2 Joint Sealant Application Equipment

The application equipment shall be inspected to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Evidences of bubbling, improper installation, failure to cure or set shall be cause to suspend operations until causes of the deficiencies are determined and corrected.

3.4.3 Joint Sealant

The joint sealant shall be inspected for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified herein at no additional cost to the Government.

3.5 CLEAN-UP

Upon completion of the project, all unused materials shall be removed from the site and the pavement shall be left in a clean condition.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

- - o 0 o - -

ENG FORM 4288 SUBMITTAL REGISTER * CONTRACT NUMBER:

TITLE AND LOCATION: * CONTRACTOR: * SPECIFICATION SECTION: 02592A

* * Field Molded Sealants for Sealing Joints in Rigid Pavements

TRAN. NO. (a)	ITEM NO. (b)	SPECIFICATION PARAGRAPH NO. (c)	DESCRIPTION OF SUBMITTAL (d)	TYPE OF SUBMITTAL (e)*	CLASS (f)*	CONTRACTOR SUBMITTAL DATES SUBMIT (g)	APPROVAL NEEDED BY (h)	MATERIALS NEEDED BY (i)	CONTRACTOR ACTION CODE (j)	DATE (k)	SUBMIT TO GOVT (l)	GOVERNMENT ACTION CODE (m)	DATE (n)	REMARKS (o)
		02592-1.2	MANUFACTURER'S RECOMMENDATIONS	SD-06	FIO									

* See SECTION 01300 for descriptions of the Types of Submittals.

* CLASS = CLASSIFICATION where GA indicates "Government Approved" submittals AND FIO indicates "For Information Only" submittals.

-- End of Section --

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02660

WATER DISTRIBUTION SYSTEMS

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 RAILWAY ENGINEERING ASSOCIATION (AREA)

\-AREA MRE-\	(1994) Manual for Railway Engineering (Fixed Properties): Chapter 1, Roadway and Ballast

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 36-\	(1994a) Carbon Structural Steel
\-ASTM A 53-\	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
\-ASTM B 88-\	(1993a) Seamless Copper Water Tube
\-ASTM C 76-\	(1995) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
\-ASTM D 1599-\	(1988) Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
\-ASTM D 1784-\	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
\-ASTM D 1785-\	(1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
\-ASTM D 2241-\	(1993) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
\-ASTM D 2464-\	(1993) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
\-ASTM D 2466-\	(1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
\-ASTM D 2467-\	(1993) Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
\-ASTM D 2564-\	(1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

\-ASTM D 2657-\	(1990) Heat-Joining Polyolefin Pipe and Fittings
\-ASTM D 2774-\	(1972; R 1983) Underground Installation of Thermoplastic Pressure Piping
\-ASTM D 2855-\	(1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
\-ASTM D 2996-\	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
\-ASTM D 2997-\	(1995) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) Pipe
\-ASTM D 3839-\	(1994a) Underground Installation of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe
\-ASTM F 477-\	(1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

\-ASME B1.20.1-\	(1983; R 1992) Pipe Threads, General Purpose (Inch)
\-ASME B16.1-\	(1989) Cast Iron Pipe Flanges and Flanged Fittings
\-ASME B16.3-\	(1992) Malleable Iron Threaded Fittings, Classes 150 and 300
\-ASME B16.26-\	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
\-ASME B36.10M-\	(1985; R 1994) Welded and Seamless Wrought Steel Pipe

AMERICAN WATER WORKS ASSOCIATION (AWWA)

\-AWWA B300-\	(1992) Hypochlorites
\-AWWA B301-\	(1992) Liquid Chlorine
\-AWWA C104-\	(1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
\-AWWA C105-\	(1988) Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
\-AWWA C110-\	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids

\-AWWA C111-\	(1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
\-AWWA C115-\	(1988) Flanged Ductile-Iron Pipe with Threaded Flanges
\-AWWA C151-\	(1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
\-AWWA C153-\	(1994) Ductile-Iron Compact Fittings, 3 In. Through 16 In., for Water and Other Liquids
\-AWWA C200-\	(1991) Steel Water Pipe - 6 In. (150 mm) and Larger
\-AWWA C203-\	(1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
\-AWWA C205-\	(1989) Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied
\-AWWA C207-\	(1994) Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In.
\-AWWA C208-\	(1983; C208a; R 1989) Dimensions for Fabricated Steel Water Pipe Fittings
\-AWWA C300-\	(1989) Reinforced Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids
\-AWWA C301-\	(1992) Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids
\-AWWA C303-\	(1987; Errata Jan 1988) Reinforced Concrete Pressure Pipe, Steel Cylinder Type, Pretensioned, for Water and Other Liquids
\-AWWA C500-\	(1993) Gate Valves for Water and Sewerage Systems
\-AWWA C502-\	(1985) Dry-Barrel Fire Hydrants
\-AWWA C503-\	(1988) Wet-Barrel Fire Hydrants
\-AWWA C504-\	(1994) Rubber-Seated Butterfly Valves
\-AWWA C509-\	(1994) Resilient-Seated Gate Valves for Water and Sewerage Systems
\-AWWA C600-\	(1993) Installation of Ductile-Iron Water Mains and Their Appurtenances
\-AWWA C606-\	(1987) Grooved and Shouldered Joints

\-AWWA C651-\	(1992) Disinfecting Water Mains
\-AWWA C700-\	(1990; C700a) Cold-Water Meters - Displacement Type, Bronze Main Case
\-AWWA C701-\	(1988) Cold-Water Meters - Turbine Type, for Customer Service
\-AWWA C702-\	(1992) Cold-Water Meters - Compound Type
\-AWWA C703-\	(1986) Cold-Water Meters - Fire Service Type
\-AWWA C704-\	(1992) Cold-Water Meters - Propeller Type for Main Line Applications
\-AWWA C706-\	(1991; C706a) Direct-Reading Remote-Registration Systems for Cold-Water Meters
\-AWWA C707-\	(1982; R 1992) Encoder-Type Remote-Registration Systems for Cold-Water Meters
\-AWWA C800-\	(1989) Underground Service Line Valves and Fittings
\-AWWA C900-\	(1989; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution
\-AWWA C901-\	(1988; Errata Apr 1988) Polyethylene (PE) Pressure Pipe and Tubing, ½ In. Through 3 In., for Water Service
\-AWWA C905-\	(1988) Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. Through 36 In.
\-AWWA C950-\	(1988) Fiberglass Pressure Pipe
\-AWWA M23-\	(1980) Manual: PVC Pipe - Design and Installation

ASBESTOS CEMENT PIPE PRODUCERS ASSOCIATION (ACPPA)

\-ACPPA-01-\	(1988) Recommended Work Practices for A/C Pipe

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

\-DIPRA-01-\	(1992; Errata May 1993) Thrust Restraint Design for Ductile Iron Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

\-MSS SP-80-\	(1987) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 24-\	(1992) Installation of Private Fire Service Mains and Their Appurtenances
\-NFPA 49-\	(1991) Hazardous Chemicals Data
\-NFPA 325M-\	(1991) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
\-NFPA 704-\	(1990) Identification of the Fire Hazards of Materials
\-NFPA 1961-\	(1992) Fire Hose

NSF INTERNATIONAL (NSF)

\-NSF Std 14-\	(1965; Rev Nov 1990) Plastics Piping System Components and Related Materials

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

\-SSPC Paint 21-\	(1991) White or Colored Silicone Alkyd Paint
\-SSPC Paint 25-\	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)

1.2 PIPING

This section covers water supply, distributionand service lines, and connections to building service at a point approximately 5 feet outside buildings and structures to which service is required. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

1.2.1 Service Lines

Piping for water service lines less than 3 inches in diameter shall be galvanized steel, polyvinyl chloride (PVC) plastic, polyethylene, or copper tubing, unless otherwise shown or specified. Piping for water service lines for sizes 3 inches and larger shall be ductile iron, polyvinyl chloride (PVC) plastic through 12 inch nominal diameter, filament-wound or centrifugally cast reinforced thermosetting resin, reinforced plastic mortar pressure pipe or steel, unless otherwise shown or specified.

1.2.2 Distribution Lines 3 Inches or Larger

Piping for water distribution lines 3 inches or larger shall be ductile iron, polyvinyl chloride (PVC) plastic through 12 inch nominal diameter, filament-wound or centrifugally cast reinforced thermosetting resin,

reinforced plastic mortar pressure pipe, or reinforced concrete, unless otherwise shown or specified.

1.2.3 Supply Lines 3 Inches or Larger

Piping for water supply lines 3 inches or larger shall be ductile iron, polyvinyl chloride (PVC) plastic through 36 inch nominal diameter, filament-wound reinforced or centrifugally cast reinforced thermosetting resin, reinforced plastic mortar pressure pipe, steel, or reinforced concrete, unless otherwise shown or specified.

1.2.4 Sprinkler Supply Lines

Piping for water lines supplying sprinkler systems for building fire protection shall conform to \-NFPA 24-\ from the point of connection with the water distribution system to the building 5 foot line.

1.2.5 Plastic Pipe

All plastic piping system components (PVC, polyethylene, thermosetting resin and reinforced plastic mortar pressure) intended for transportation of potable water shall comply with \-NSF Std 14-\ and shall be legibly marked with their symbol.

1.2.6 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section \=02222=\ EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

1.3 DELETED [AM#1]

1.4 *MANUFACTURER'S REPRESENTATIVE*

The Contractor shall negotiate to have a manufacturer's field representative present at the jobsite during the installation and testing of PE, RTRP, and/or RPMP pipe to provide technical assistance and to verify that the materials are being installed in accordance with the manufacturer's prescribed procedures. When the representative feels that the Contractor is installing and testing the PE, RTRP, and/or RPMP pipe in a satisfactory manner, certification shall be written to note which individuals employed by the Contractor are capable of properly installing the pipe. The field representative shall advise the Contractor of unsatisfactory conditions immediately when they occur. Such conditions include improper diameter of pipe ends, damaged interior liner, poorly prepared joints, improper curing of joints, moving pipe before joints are cured, bending pipe to follow abrupt changes in trench contours, leaving pipe ends open in trench overnight, not properly drying joints after rain storms, exceeding effective adhesive life, sharp objects in trench bed, backfill that could damage pipe, improper procedure for concrete encasement of pipe, omission of thrust blocks at changes in direction or any other

conditions which could have an adverse effect on the satisfactory completion and operation of the piping system.

1.5 SUBMITTALS

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

SD-06 Instructions\

Installation\; *FIO*\.

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

SD-08 Statements\

Waste Water Disposal Method\; *FIO*\.

The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.

Satisfactory Installation\; *FIO*\.

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

SD-09 Reports\

Bacteriological Disinfection\; *FIO*\.

Test results from commercial laboratory verifying disinfection.

SD-13 Certificates\

Manufacturer's Representative\; *FIO*\.

The name and qualifications of the manufacturer's representative and written certification from the manufacturer that the representative is technically qualified in all phases of PE, RTRP, and/or RPMP pipe laying and jointing and experienced to supervise the work and train the Contractor's field installers, prior to commencing installation.

Installation\; *FIO*\.

A statement signed by the manufacturer's field representative certifying that the Contractor's personnel are capable of properly installing the pipe on the project.

Meters\; *FIO*\.

Manufacturer's certificate stating that each meter furnished has been tested for accuracy of registration and compliance with the accuracy and capacity requirements of the appropriate AWWA standard.

1.6 HANDLING

Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

1.6.1 Coated and Wrapped Steel Pipe

Coated and wrapped steel pipe shall be handled in conformance with \-AWWA C203-\.

1.6.2 Polyethylene (PE) Pipe

PE pipe, fittings, and accessories shall be handled in conformance with \-AWWA C901-\.

1.6.3 Miscellaneous Plastic Pipe and Fittings

Polyvinyl Chloride (PVC), Reinforced Thermosetting Resin Pipe (RTRP), and Reinforced Plastic Mortar Pressure (RPMP) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with \-NFPA 704-\, with classification as indicated in \-NFPA 49-\ and \-NFPA 325M-\.

PART 2 - PRODUCTS

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Reinforced and Prestressed Concrete Pipe

Steel-cylinder reinforced concrete pipe shall conform to \-AWWA C300-\, \-AWWA C301-\, or \-AWWA C303-\ and shall be designed to withstand a working pressure of not less than 150 psi unless otherwise shown or specified.

2.1.2 Plastic Pipe

2.1.2.1 Polyethylene Plastic (PE)

Pipe, tubing, and heat-fusion fittings shall conform to \-AWWA C901-\.

2.1.2.2 Polyvinyl Chloride (PVC) Plastic Pipe

Pipe, couplings and fittings shall be manufactured of material conforming to \-ASTM D 1784-\, Class 12454B.

a. Pipe Less Than 4 inch Diameter:

(1) Screw-Joint: Pipe shall conform to dimensional requirements of \-ASTM D 1785-\ Schedule 80, with joints meeting requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified. Pipe couplings when used, shall be tested as required by \-ASTM D 2464-\.

(2) Elastomeric-Gasket Joint: Pipe shall conform to dimensional requirements of \-ASTM D 1785-\. Schedule 40 with joints meeting the requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified, or it may be pipe conforming to requirements of \-ASTM D 2241-\, elastomeric joint, with the following applications:

SDR	Maximum Working Pressure psi	Minimum Hydrostatic Pressure psi
26	100	133
21	120	160
17	150	200
13.5	200	266

(3) Solvent Cement Joint: Pipe shall conform to dimensional requirements of \-ASTM D 1785-\ or \-ASTM D 2241-\ with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure.

b. Pipe 4 Inch through 12 Inch Diameter: Pipe, couplings and fittings shall conform to \-AWWA C900-\, Class 150, CIOD pipe dimensions, elastomeric-gasket joint, unless otherwise shown or specified.

c. Pipe 14 Inch through 36 Inch Diameter: Pipe shall conform to \-AWWA C905-\ unless otherwise shown or specified.

2.1.3 Reinforced Plastic Mortar Pressure (RPMP) Pipe

\-AWWA C950-\.

2.1.4 Reinforced Thermosetting Resin Pipe (RTRP)

Pipe shall have a quick-burst strength greater than or equal to four times the normal working pressure of the pipe. The quick-burst strength test shall conform to the requirements of \-ASTM D 1599-\.

2.1.4.1 RTRP-I

RTRP-I shall conform to \-ASTM D 2996-\, except pipe shall have an outside diameter equal to cast iron outside diameter or standard weight steel pipe. The pipe shall be suitable for a normal working pressure of 150 psi at 73 degrees F. The inner surface of the pipe shall have a smooth uniform continuous resin-rich surface liner conforming to \-ASTM D 2996-\.

2.1.4.2 RTRP-II

RTRP-II shall conform to \-ASTM D 2997-\. Pipe shall have an outside diameter equal to standard weight steel pipe.

2.1.5 Ductile-Iron Pipe

Ductile-iron pipe shall conform to \-AWWA C151-\, working pressure not less than 150 psi, unless otherwise shown or specified. Pipe shall be cement-mortar lined in accordance with \-AWWA C104-\. Linings shall be standard. 10 mil thick polyethylene in accordance with \-AWWA C105-\.] Flanged ductile iron pipe with threaded flanges shall be in accordance with \-AWWA C115-\.

2.1.6 Steel Pipe

2.1.6.1 Pipe 3 Inches and Larger, Not Galvanized

Steel pipe, not galvanized, shall conform to \-AWWA C200-\ with dimensional requirements as given in \-ASME B36.10M-\ for pipe 6 inches in diameter and larger, and \-ASTM A 53-\ for smaller sizes. Pipe shall be welded or seamless with plain or shouldered and grooved ends in accordance with \-AWWA C606-\ for use with mechanical couplings or bell-and-spigot ends with rubber gaskets. Bell-and-spigot ends for sizes less than 6 inches diameter shall be as required by \-AWWA C200-\.

2.1.6.2 Galvanized-Steel Pipe

Galvanized-steel pipe shall conform to \-ASTM A 53-\, standard weight.

2.1.6.3 Protective Materials for Steel Pipe

Protective materials for steel pipe, except as otherwise specified, shall be mechanically applied in a factory or plant especially equipped for the purpose. The materials shall, unless otherwise indicated on the drawings, consist of the following for the indicated pipe material and size:

a. Pipe and fittings less than 3 inches in diameter shall be thoroughly cleaned of foreign material by wire brushing and solvent cleaning, and then given one coat of coal-tar primer and two coats of coal-tar enamel conforming to \-AWWA C203-\; threaded ends of pipe and fittings shall be adequately protected prior to coating.

b. Pipe 3 Inches or Larger, Not Galvanized:

(1) Cement-mortar coating and lining shall conform to and shall be applied in conformity with \-AWWA C205-\. Cement-mortar coating and linings shall not be used for pipe less than 4 inches in diameter.

(2) Coal-tar enamel lining, coating and wrapping shall conform to \-AWWA C203-\ for materials, method of application, tests and handling. Non-asbestos material shall be used for the outerwrap.

(3) Cement-mortar lining, in lieu of coal-tar enamel lining, may be used with coal-tar enamel coating and wrapping. Cement-mortar lining shall conform to and shall be applied in conformity with \-AWWA C205-\.

2.1.7 Copper Tubing

Copper tubing shall conform to \-ASTM B 88-\, Type K, annealed.

2.2 FITTINGS AND SPECIALS

2.2.1 Reinforced Concrete Pipe

Fittings and specials required for closures, curves, bends, branches and connections to valves, pipe, or structures shall be approved by the Contracting Officer and conform to the details furnished by the manufacturer and to \-AWWA C300-\, \-AWWA C301-\, or \-AWWA C303-\ as applicable.

2.2.2 Polyvinyl Chloride (PVC) Pipe

a. For pipe less than 4 inch diameter, fittings for threaded pipe shall conform to requirements of \-ASTM D 2464-\, threaded to conform to the requirements of \-ASME B1.20.1-\ for use with Schedule 80 pipe and fittings, fittings for solvent cement jointing shall conform to \-ASTM D 2466-\ or \-ASTM D 2467-\, and fittings for elastomeric-gasket joint pipe shall be iron conforming to \-AWWA C110-\ or \-AWWA C111-\. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with \-AWWA C104-\.

b. For pipe 4 inch diameter and larger, fittings and specials shall be iron, bell end in accordance with \-AWWA C110-\, 150 psi pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or may be fittings and specials of the same material as the pipe with elastomeric gaskets, all in conformance with \-AWWA C900-\. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with \-AWWA C104-\. Fittings shall be bell and spigot or plain end pipe, or as applicable. Ductile iron compact fittings shall be in accordance with \-AWWA C153-\.

2.2.3 RTRP and RPMP Pipe

Fittings and specials shall be compatible with the pipe supplied. Filament wound or molded fittings up to 6 inches shall conform to \-AWWA C950-\. Iron fittings shall be cement-mortar lined in accordance with \-AWWA C104-\ and shall conform to \-AWWA C110-\ and \-AWWA C111-\. Fittings shall be suitable for working and testing pressures specified for the pipe.

2.2.4 Ductile-Iron Pipe

Fittings and special shall be suitable for 150 psi pressure rating, unless otherwise specified. Fittings and specials for mechanical joint pipe shall conform to \-AWWA C110-\. Fittings and specials for use with push-on joint pipe shall conform to \-AWWA C110-\ and \-AWWA C111-\. Fittings and specials for grooved and shouldered end pipe shall conform to \-AWWA C606-\. Fittings and specials shall be cement-mortar lined (standard thickness) in accordance with \-AWWA C104-\. Ductile iron compact fittings shall conform to \-AWWA C153-\.

2.2.5 Steel Pipe

2.2.5.1 Steel Pipe Not Galvanized

Fittings and specials shall be made of the same material as the pipe. Specials and fittings may be made of standard steel tube turns or segmentally welded sections, with ends to accommodate the type of couplings or joints specified for the pipe. Dimensions of steel-pipe fittings shall be in accordance with \-AWWA C208-\. The thickness and pressure rating of pipe fittings and specials shall be not less than the thickness specified and the pressure rating calculated for the pipe with which they are used. Protective materials for fittings and specials shall be as specified for the pipe. Specials and fittings that cannot be mechanically lined, coated, and wrapped shall be lined, coated, and wrapped by hand, using the same material used for the pipe with the same number of applications of each material carefully and smoothly applied.

2.2.5.2 Galvanized-Steel Pipe

Steel fittings shall be galvanized. Screwed fittings shall conform to \-ASME B16.3-\. Flanged fittings shall conform to \-AWWA C207-\.

2.2.5.3 Dielectric Fittings

Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

2.2.6 Copper Tubing

Fittings and specials shall be flared and conform to \-ASME B16.26-\.

2.3 JOINTS

2.3.1 Reinforced Concrete Pipe

Rubber-gasket joints shall be of the type using a bell-and-spigot joint design of steel. The gaskets shall conform to \-AWWA C300-\, \-AWWA C301-\, or \-AWWA C303-\, as applicable.

2.3.2 Plastic Pipe

2.3.2.1 Polyethylene (PE) Pipe

Joints for pipe fittings and couplings shall be strong tight joints as specified for PE in Paragraph INSTALLATION. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendation as approved by the Contracting Officer.

2.3.2.2 Polyvinyl Chloride Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations as approved by the Contracting Officer.

2.3.3 RPMP Pipe

Joints shall be mechanical or bell and spigot type with elastomeric gasket.

2.3.4 RTRP

2.3.4.1 RTRP-I, Grade I and 2

Joints shall be bell and spigot with elastomeric gasket, mechanical coupling with elastomeric gasket, threaded and bonded coupling, or tapered bell and spigot with compatible adhesive. All RTRP-I materials shall be products of a single manufacturer.

2.3.4.2 RTRP-II, Grade 1 and 2

Joints shall be the bell and spigot type with elastomeric gasket, bell and spigot with adhesive, butt-jointed with adhesive bonded reinforced overlay, mechanical, flanged, threaded or commercially available proprietary joints, provided they are capable of conveying water at the pressure and temperature of the pipe.

2.3.5 Ductile-Iron Pipe

a. Mechanical joints shall be of the stuffing box type and shall conform to \-AWWA C111-\.

b. Push-on joints shall conform to \-AWWA C111-\.

c. Rubber gaskets and lubricant shall conform to the applicable requirements of \-AWWA C111-\.

2.3.6 Steel Pipe

2.3.6.1 Steel Pipe, Not Galvanized

a. Mechanical couplings shall be as hereinafter specified.

b. Bell-and-spigot joints for use with rubber gaskets shall conform to \-AWWA C200-\, as appropriate for the type of pipe. Rubber gaskets shall conform to applicable requirements of \-AWWA C200-\.

c. Flanges shall conform to \-AWWA C207-\, and shall be used only in above ground installation or where shown on the drawings, or when approved.

2.3.6.2 Mechanical Couplings

Mechanical couplings for steel pipe shall be the sleeve type, or when approved, the split-sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movements caused by expansion, contraction, slight setting or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Couplings shall be of strength not less than the adjoining pipeline.

2.3.7 Bonded Joints

Where indicated and for all ferrous pipe, a metallic bond shall be provided at each joint, including joints made with flexible couplings, caulking, or rubber gaskets, of ferrous-metallic piping to effect continuous conductivity. The bond wire shall be Size 1/0 copper conductor suitable for direct burial shaped to stand clear of the joint. The bond shall be of the thermal weld type.

2.3.8 Isolation Joints

Isolation joints shall be installed between nonthreaded ferrous and nonferrous metallic pipe, fittings and valves. Isolation joints shall consist of a sandwich-type flange isolation gasket of the dielectric type, isolation washers, and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

a. Sleeve-type couplings shall be used for joining plain end pipe sections. The two couplings shall consist of one steel middle ring, two steel followers, two gaskets, and the necessary steel bolts and nuts to compress the gaskets.

b. Split-sleeve type couplings may be used in aboveground installations when approved in special situations and shall consist of gaskets and a housing in two or more sections with the necessary bolts and nuts.

2.3.9 Copper Tubing

Joints shall be compression-pattern flared and shall be made with fittings hereinafter specified.

2.4 VALVES

2.4.1 Check Valves

Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The

size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve.

a. Valves 2 inches and smaller shall be all bronze designed for screwed fittings, and shall conform to \-MSS SP-80-\, Class 150, Types 3 and 4 as suitable for the application.

b. Valves larger than 2 inches shall be iron body, bronze mounted, shall have flanged ends, and shall be the non-slam type. Flanges shall be the Class 125 type conforming to \-ASME B16.1-\.

2.4.2 Gate Valves

Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

a. Valves smaller than 3 inches shall be all bronze and shall conform to \-MSS SP-80-\, Type 1, Class 150.

b. Valves 3 inches and larger shall be iron body, bronze mounted, and shall conform to \-AWWA C500-\. Flanges shall not be buried. An approved pit shall be provided for all flanged connections.

c. Resilient-Seated Gate Valves: For valves 3 to 12 inches in size, resilient-seated gate valves shall conform to \-AWWA C509-\.

2.4.3 Rubber-Seated Butterfly Valves

Rubber-seated butterfly valves shall conform to the performance requirements of \-AWWA C504-\. Wafer type valves conforming to the performance requirements of \-AWWA C504-\ in all respects, but not meeting laying length requirements will be acceptable if supplied and installed with a spacer providing the specified laying length. All tests required by \-AWWA C504-\ shall be met. Flanged-end valves shall be installed in an approved pit and provided with a union or sleeve-type coupling in the pit to permit removal. Mechanical-end valves 3 inches through 10 inches in diameter may be direct burial if provided with a suitable valve box, means for manual operation, and an adjacent pipe joint to facilitate valve removal. Valve operators shall restrict closing to a rate requiring approximately 60 seconds, from fully open to fully closed.

2.4.4 Indicator Post for Valves

Each valve shown on the drawings with the designation "P.I.V." shall be equipped with indicator post conforming to the requirements of \-NFPA 24-\. Operation shall be by a wrench which will be attached to each post.

2.5 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with

flared base. The minimum thickness of metal shall be 3/16 inch. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

2.6 VALVE PITS

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown. Concrete shall have compressive strength of 3000 psi in accordance with Section \=03300=\ CAST-IN-PLACE STRUCTURAL CONCRETE.

2.7 FIRE HYDRANTS

Hydrants shall be dry-barrel type conforming to \-AWWA C502-\ with valve opening at least 5 inches in diameter and designed so that the flange at the main valve seat can be removed with the main valve seat apparatus remaining intact, closed and reasonably tight against leakage and with a breakable valve rod coupling and breakable flange connections located no more than 8 inches above the ground grade . Hydrants shall have a 6 inch bell connection, two 2-1/2 inch hose connections and one 4-1/2 inch pumper connection. Outlets shall have American National Standard fire-hose coupling threads. Working parts shall be bronze. Design, material, and workmanship shall be similar and equal to the latest stock pattern ordinarily produced by the manufacturer. Hydrants shall be painted with one coat of red iron oxide, zinc oxide primer conforming to \-SSPC Paint 25-\ and two finish coats of silicone alkyd paint conforming to \-SSPC Paint 21-\, of the installation's standard colors or as directed by the Contracting Officer. Suitable bronze adapter for each outlet, with caps, shall be furnished.

2.8 MISCELLANEOUS ITEMS

2.8.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.8.2 Corporation Stops

Corporation stops shall have standard corporation stop thread conforming to \-AWWA C800-\ on the inlet end, with flanged joints, compression pattern flared tube couplings, or wiped joints for connections to goosenecks.

2.8.3 Goosenecks

Copper tubing for gooseneck connections shall conform to the applicable requirements of \-ASTM B 88-\, Type K, annealed. Length of cable requirement connections shall be in accordance with standard practice.

2.8.4 Service Stops

Service stops shall be water-works inverted-ground-key type, oval or round flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. All parts shall be of bronze with female iron-pipe-size connections or compression-pattern flared tube couplings, and shall be designed for a hydrostatic test pressure not less than 200 psi.

2.8.5 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable-iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 150 psi. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

2.8.6 Service Boxes

Service boxes shall be cast iron or concrete and shall be extension service boxes of the length required for the depth of the line, with either screw or slide-type adjustment. The boxes shall have housings of sufficient size to completely cover the service stop or valve and shall be complete with identifying covers.

2.8.7 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: \-AWWA B301-\.

Hypochlorite, Calcium and Sodium: \-AWWA B300-\.

2.8.8 *Meters*

Meters shall be of the encoded type with bronze positive displacement to include scancoder with waterproof glass lens and potted terminals for flooded pit installation and 3-wire cable output such as Kent Model C-700 or SP-TMSCM as manufactured by Kent Meters Inc., or an approved equal. The contractor shall furnish a meter interface (MIU) or units as required to read the new water meters. The MIU(s) shall be telephone powered and compatible with all of the requirements of the new water meters such as the Model IE-4 as manufactured by International Teledata Corp., or an approved equal. Meters and MIU(s) of each of the various types furnished and installed under this contract shall be supplied by one manufacturer.

2.8.9 Meter Boxes

Meter boxes shall be of cast iron, concrete, or plastic. The boxes shall be of sufficient size to completely enclose the meter and shut-off valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron, or concrete with cast iron lid and cast iron meter reader lid. Boxes set in sidewalks, not subject to vehicular traffic, shall use concrete covers with cast iron meter reader lids or shall be concrete with cast iron lid and cast iron meter reader lid. Plastic boxes and lids shall only be used in unpaved areas or grass areas not subject to vehicular traffic. Box height shall extend from invert of the meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.

PART 3 - EXECUTION

3.1 *INSTALLATION* Shall be in accordance with the following paragraphs and SECTION 02222-EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS**. [AM#1]**

3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Squeeze type mechanical cutters shall not be used for ductile iron.

3.1.2 Adjacent Facilities

3.1.2.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.

3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

3.1.2.3 Copper Tubing

Copper tubing shall not be installed in the same trench with ferrous piping materials.

3.1.2.4 Nonferrous Metallic Pipe

Where nonferrous metallic pipe, e.g. copper tubing, crosses any ferrous piping material, a minimum vertical separation of 12 inches shall be maintained between pipes.

3.1.2.5 Casing Pipe

Water pipe shall be encased in a sleeve of rigid conduit for the lengths shown. Where sleeves are required, in all other cases, the pipe sleeve shall be reinforced concrete in accordance with \-ASTM C 76-\, Class V as specified for storm drains in Section \=02720=\ STORM-DRAINAGE SYSTEM. A minimum clearance of at least 2 inches between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Sand bedding or suitable pipe support shall be provided for the water pipe through the sleeve. Sleeves of ferrous material shall be provided with corrosion protection as required for the conditions encountered at the site of the installation.

3.1.2.6 Structures

Where water pipe is required to be installed within 3 feet of existing structures, the water pipe shall be sleeved as required in Paragraph "Casing Pipe". The Contractor shall take proper precautions during installation of the water pipe and sleeve to ensure that there will be no damage to the structures and no settlement or movement of foundations or footings.

3.1.3 Joint Deflection

3.1.3.1 Reinforced Concrete Pipe

Maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall be 5 degrees for reinforced concrete pipe unless a lesser amount is recommended by the manufacturer. Long radius curves in reinforced concrete pipe shall be formed by straight pipe in which spigot rings are placed on a bevel. Slight deflections may be made by straight pipe, provided that the maximum joint opening caused by such deflections does not exceed the maximum recommended by the pipe manufacturer. Short-radius curves and closures shall be formed by shorter lengths of pipe, bevels, or fabricated specials specified.

3.1.3.2 Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but in no case shall it exceed 5 degrees.

3.1.3.3 Ductile-Iron Pipe

The maximum allowable deflection shall be as given in \-AWWA C600-\. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

3.1.3.4 Steel Pipe

For pipe with bell-and-spigot rubber-gasket joints, maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets shall be 5 degrees unless a lesser amount is recommended by the manufacturer. Short-radius curves and closures shall be formed by short lengths of pipe or fabricated specials specified.

3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Under no circumstances shall any of the water-line materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

3.1.4.1 Reinforced Concrete Pipe Installation

Reinforced concrete pipe shall be installed in accordance with recommendations of the pipe manufacturer. Before laying reinforced concrete pipe, the outside surface of the spigot and the inside surface of the bell shall be cleaned and an acceptable vegetable-compound lubricant applied to the inside surface of the bell and to the rubber gasket. Where prescribed by the pipe manufacturer, the gasket shall be placed in the groove on the end of the pipe before the pipe is placed in the trench. After the pipe has been forced together, the position of the rubber gasket shall be checked with a feeler gauge in accordance with the pipe manufacturer's recommendations. Tapping of reinforced concrete cylinder pipe shall be done in accordance with the manufacturer's approved recommendations. Where the manufacturer recommends that the taps be made by attaching the rubber-gasket saddle to the outside of the pipe using U-bolts, the saddle shall be grouted in if necessary, the mortar coating shall be chipped away even with the hole in the saddle plate. The exposed circumferential wires shall be removed and the cylinder and concrete core drilled out, and the steel saddle and U-bolts shall be protected by concrete encasement.

3.1.4.2 Plastic Pipe Installation

RTRP shall be installed in accordance with \-ASTM D 3839-\. RPMP shall be installed in accordance with the recommendations of the manufacturer. PE Pipe shall be installed in accordance with \-ASTM D 2774-\. PVC pipe shall be installed in accordance with \-AWWA M23-\.

3.1.4.3 Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with \-ACPPA-01-\.

3.1.4.4 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

3.1.4.5 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

3.1.5 Jointing

3.1.5.1 Reinforced-Concrete Pipe

The inside and outside annular spaces between abutting sections of concrete pipe shall be filled with rich cement mortar in accordance with the recommendations of the pipe manufacturer. Excess mortar shall be removed from interior annular spaces, leaving a smooth and continuous surface between pipe sections. Exposed portions of steel joint rings shall be protected from corrosion by a metallic coating or by an approved nonmetallic coating. Rubber gaskets shall be handled, lubricated where necessary, and installed in accordance with the recommendations of the pipe manufacturer.

3.1.5.2 Polyethylene (PE) Pipe

Jointing shall comply with \-ASTM D 2657-\, Technique I-Socket Fusion or Technique II-Butt Fusion.

3.1.5.3 Polyvinyl Chloride (PVC) Plastic Pipe

a. Pipe less than 4 inch diameter: Threaded joints shall be made by wrapping the male threads with approved thread tape or applying an approved lubricant, then threading the joining members together. The joint shall be tightened using strap wrenches to prevent damage to the pipe and/or fitting. To avoid excessive torque, joints shall be tightened no more than one thread past hand-tight. Preformed rubber-ring gaskets for elastomeric-gasket joints shall be made in accordance with requirements of \-ASTM F 477-\ and as required herein. All pipe ends for push-on joints shall be beveled to facilitate assembly and marked to indicate when the pipe is fully seated. The gasket shall be prelubricated to prevent displacement. The gasket and ring groove in the bell or coupling shall match. The manufacturer of the pipe or fitting shall supply the elastomeric gasket. Couplings shall be provided with stops or centering rings to assure that the coupling is centered on the joint. Solvent cement joints shall use sockets conforming to the requirements of \-ASTM D 2467-\. The solvent cement used shall meet the requirements of \-ASTM D 2564-\; the

joint assembly shall be made in accordance with \-ASTM D 2855-\ and the manufacturer's specific recommendations.

b. Pipe 4 inch through 12 inch diameter: Joints shall be elastomeric-gasket as specified in \-AWWA C900-\. Jointing procedure shall be as specified for pipe less than 4 inch diameter with configuration using elastomeric ring gasket.

c. Pipe 14 inch through 36 inch diameter: Joints shall be elastomeric-gasket push-on joints made in accordance with \-AWWA M23-\.

3.1.5.4 RTRP I, RTRP II and RPMP Pipe

a. RTRP I: Assembly of the pipe shall be done in strict conformance with the manufacturer's written instruction and installation procedures. Field joints shall be prepared as specified by the pipe manufacturer. Several pipe joints having interference-fit type couplings may be field bonded and cured simultaneously. However, the pipe shall not be moved nor shall additional joints be made until the previously laid joints are completely cured. Joints not having interference-fit type coupling shall be fitted with a clamp which shall hold the joint rigidly in place until the joint cement has completely cured. The clamps shall have a protective material on the inner surface to prevent damage to the plastic pipe when the clamp is tightened in place. The pipe manufacturer shall provide a device or method to determine when the joint is pulled against the pipe stop. Additionally, the pipe manufacturer shall furnish a gauge to measure the diameter of the spigot ends to ensure the diameter conforms to the tolerances specified by the manufacturer. All pipe ends shall be gauged. Factory certified tests shall have been satisfactorily performed to verify that short-term rupture strength is 1,500 psi or greater when carried out in accordance with \-ASTM D 1599-\. All field bonded epoxy-cemented joints, regardless of ambient temperature, shall be cured with a self-regulating thermostatically temperature controlled electrical heating blanket for the time and temperature recommended by the manufacturer for the applicable size and type of joint, or by an alternate heating method recommended by the manufacturer and approved by the Contracting Officer. The joint sections shall not be moved during heating or until the joint has cooled to ambient temperature.

b. RTRP II: A reinforced overlay joint shall be used to join sections together through a placement of layers of reinforcement fiberglass roving, mat, tape or fabric thoroughly saturated with compatible catalyzed resin.

c. Fittings and Specials for RTRP and RPMP Pipe: Metal to RTRP and RPMP pipe connections shall be made by bolting steel flanges to RTRP and RPMP pipe flanges. Cast-iron fitting with gasket bell or mechanical joint may be used with RTRP if pipe has cast iron outside diameter. Steel flanges shall be flat-faced type. Where raised-face steel flanges are used, spacer rings shall be used to provide a flat-face seat for RTRP and RPMP pipe flanges. A full-face Buna "N" gasket 1/8 inch thick with a shore hardness of 50-60 shall be used between all flanged connections. The RTRP and RPMP pipe flange shall have raised sealing rings. Flat washers shall be used under all nuts and bolts on RTRP and RPMP pipe flanges. Bolts and nuts shall be of noncorrosive steel and torqued to not more than 100 foot pounds. Flanges shall not be buried. A concrete pit shall be provided for all flanged connections.

3.1.5.5 Ductile-Iron Pipe

Mechanical and push-on type joints shall be installed in accordance with \-AWWA C600-\ for buried lines or \-AWWA C606-\ for grooved and shouldered pipe above ground or in pits.

3.1.5.6 Steel Pipe, Not Galvanized

a. Mechanical Couplings: Mechanical couplings shall be installed in accordance with the recommendations of the couplings manufacturer.

b. Rubber Gaskets: Rubber gaskets shall be handled, lubricated where necessary, and installed in accordance with the recommendations of the pipe manufacturer.

3.1.5.7 Galvanized-Steel Pipe

Screw joints shall be made tight with a stiff mixture of graphite and oil, inert filler and oil, or with an approved graphite compound, applied with a brush to the male threads only. Compounds shall not contain lead.

3.1.5.8 Copper Tubing

Joints shall be made with flared fittings. The flared end tube shall be pulled tightly against the tapered part of the fitting by a nut which is part of the fitting, so there is metal-to-metal contact.

3.1.5.9 Bonded Joints

Bonded joints shall be installed in accordance with details specified for joints in paragraph JOINTS.

3.1.5.10 Isolation Joints and Dielectric Fittings

Isolation joints and dielectric fittings shall be installed in accordance with details specified in paragraph JOINTS. Dielectric unions shall be encapsulated in a field-poured coal-tar covering, with at least 1/8 inch thickness of coal tar over all fitting surfaces.

3.1.5.11 Connections

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

3.1.6 Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point approximately 5 feet outside the building where such building service exists. Where building services are not installed, the Contractor shall terminate the service lines approximately 5 feet from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes. Service lines shall be constructed in accordance with the following requirements:

3.1.6.1 Service Lines 2 Inches and Smaller

Service lines 2 inches and smaller shall be connected to the main by a directly-tapped corporation stop or by a service clamp. A corporation stop and a copper gooseneck shall be provided with either type of connection. Maximum sizes for directly-tapped corporation stops and for outlets with service clamps shall be as in TABLE I. Where 2 or more gooseneck connections to the main are required for an individual service, such connections shall be made with standard branch connections. The total clear area of the branches shall be at least equal to the clear area of the service which they are to supply.

TABLE I. SIZE OF CORPORATION STOPS AND OUTLETS

Pipe Size Inches	Corporation Stops, Inches For Ductile-Iron Pipe	Outlets w/Service Clamps, Inches Single & Double Strap
3	--	1
4	1	1
6	1-1/4	1-1/2
8	1-1/2	2
10	1-1/2	2
12 & larger	2	2

3.1.6.2 Service Lines 1-1/2 Inch and Smaller

Service lines 1-1/2 inches and smaller shall have a service stop.

3.1.6.3 Service Lines 2 Inches in Size

Service lines 2 inches in size shall have a gate valve.

3.1.6.4 Service Lines Larger than 2 Inches

Service lines larger than 2 inches shall be connected to the main by a tapped saddle, tapping sleeve and valve, service clamp or reducing tee, depending on the main diameter and the service line diameter, and shall have a gate valve. Lines 3 inches and larger may use rubber-seated butterfly valves as specified above, or gate valves.

3.1.6.5 Service Lines for Sprinkler Supplies

Water service lines used to supply building sprinkler systems for fire protection shall be connected to the water distribution main in accordance with \-NFPA 24-\.

3.1.7 Field Coating and Lining of Pipe

3.1.7.1 Steel Pipe 3 In. and Larger, Not Galvanized

a. Cement-mortar coating and lining: Field jointing shall conform to Appendix, \-AWWA C205-\. Any defective area found in the coating and/or lining of pipe and joints shall be removed to the pipe wall and repaired. The repaired areas shall be at least equal in thickness to the minimum coating and/or lining required for the pipe. Steel reinforcement in the coating shall be repaired or replaced as necessary to assure a complete and soundly reinforced coating.

b. Coal-tar enamel coating, lining and wrapping: Field jointing shall conform to \-AWWA C203-\. The applied materials shall be tested by means of a spark-type electrical inspection device in accordance with the requirements of \-AWWA C203-\. Any flaws or holidays found in the coating and/or lining of pipe and joints shall be repaired by patching or other approved means. The repaired areas shall be at least equal in thickness to the minimum coating and/or lining required for the pipe.

3.1.7.2 Galvanized-Steel Pipe

Field joints shall be given one coat of coal-tar primer and two coats of coal-tar enamel conforming to \-AWWA C203-\. The tests of the coating shall conform to \-AWWA C203-\, and any flaws or holidays found in the coating of pipe and joints shall be repaired by patching or other approved means such that the repaired areas will be at least equal in thickness to the minimum coating required for the pipe.

3.1.8 Setting of Fire Hydrants, Meters, Valves and Valve Boxes

3.1.8.1 Fire Hydrants

Fire hydrants shall be located and installed as shown. Each hydrant shall be connected to the main with a 6 inch branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the roadway, with the center of the lowest outlet not less than 18 inches above the finished surrounding grade, and the operating nut not more than 48 inches above the finished surrounding grade. Fire hydrants designated on the drawings as low profile shall have the lowest outlet not less than 18 inches above the finished surrounding grade, the top of the hydrant not more than 24 inches above the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished gradeline immediately after installation to obtain beneficial use of the hydrant as soon as practicable. The hydrant shall be set upon a slab of concrete not less than 4 inches thick and 15 inches square. Not less than 7 cubic feet of free-draining broken stone or gravel shall be placed around and beneath the waste opening of dry barrel hydrants to ensure drainage.

3.1.8.2 Meters

Meters and meter boxes shall be installed at the locations shown on the drawings. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

3.1.8.3 Valves

After delivery, valves, including those in hydrants, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and hydrants and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Check, pressure reducing, vacuum, and air relief valves shall be installed in valve pits. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be carefully tamped around each valve box or pit to a distance of 4 feet on all sides of the box, or the undisturbed trench face if less than 4 feet.

3.1.8.4 Service Boxes

Where water lines are located below paved streets having curbs, the boxes shall be installed directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

3.1.9 Tapped Tees and Crosses

Tapped tees and crosses for future connections shall be installed where shown.

3.1.10 Thrust Restraint

Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, on waterlines 4 inches in diameter or larger, and fire hydrants shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

3.1.10.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2,000 psi after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.10.2 Restrained Joints

For ductile-iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with \-DIPRA-01-\.

3.2 \+HYDROSTATIC TESTS+

Where any section of a water line is provided with concrete thrust blocking for fitting or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved.

3.2.1 \+Pressure Test+

After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 200 psi. Water supply lines designated on the drawings shall be subjected for 1 hour to a hydrostatic pressure test of 200 psi. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves, discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

a. Wet or unstable soil conditions in the trench.

b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.

c. Maintaining the trench in an open condition would delay completion of the contract.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section \=02222=\ EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2.2 \+Leakage Test+

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 200 psi pressure. Water supply lines designated on the drawings shall be subjected to a pressure equal to 200 psi. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain pressure within 5 psi of the specified leakage test pressure after the pipe has been filled

with water and the air expelled. No piping installation will be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

L = 0.0001351ND(P raised to ½ power)

L = Allowable leakage in gallons per hour
N = Number of joints in the length of pipeline tested
D = Nominal diameter of the pipe in inches
P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

3.2.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

3.2.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be satisfactory as specified. All replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

a. Pressure test and leakage test may be conducted concurrently.

b. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

3.3 DISINFECTION

3.3.1 *Bacteriological Disinfection*

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed by \-AWWA C651-\. From several points in the unit, personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with state approved methods. The commercial laboratory must be certified by the state's approving authority for examination of potable water. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full

days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

3.3.2 Lead Residual

Following the bacteriological disinfection and testing, the system shall be flushed with a sufficient velocity of water and sufficient tests performed at each hot- and cold-water discharge point until no more than 15 ppb lead residuals remain in the system. All tests and samples shall be performed in accordance with state and, if applicable, Federal regulations. Samples for testing are to be collected after a 6-hour continuous period of no flushing, and will be considered first draw samples. The commercial laboratory must be certified by the state's approving authority for examination of potable water. Lead residual test results are to be submitted to the Contracting Officer. The system will not be accepted until satisfactory bacteriological results and lead residual test results have been obtained. All flushing and testing for lead residuals, including all costs, are the responsibility of the Contractor.

3.4 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02685

GAS DISTRIBUTION SYSTEMS

12/90

PART
1 - GENERAL

1.1 REFERENCES

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

AMERICAN GAS ASSOCIATION (AGA)

\-AGA-01-\	(1989) A.G.A. Plastic Pipe Manual for Gas Service

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI B109.2-\	(1992) Diaphragm Type Gas Displacement Meters (Over 500 Cubic Feet per Hour Capacity)

AMERICAN PETROLEUM INSTITUTE (API)

\-API Spec 5L-\	(1995) Line Pipe
\-API Spec 6D-\	(1994; Supple June 1996) Pipeline Valves, (Gate, Plug, Ball, and Check Valves)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 53-\	(1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
\-ASTM A 181-\	(1995b) Forgings, Carbon Steel, for General-Purpose Piping
\-ASTM D 2513-\	(1995c) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
\-ASTM D 2517-\	(1994) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
\-ASTM D 2683-\	(1993) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
\-ASTM D 3261-\	(1993) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
\-ASTM D 3308-\	(1991a) PTFE Resin Skived Tape

\-ASTM D 3350-\	(1993) Polyethylene Plastics Pipe and Fittings Materials

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

\-ASME B1.20.1-\	(1983; R 1992) Pipe Threads, General Purpose (Inch)
\-ASME B16.5-\	(1988; Errata Oct 1988; B16.5a) Pipe Flanges and Flanged Fittings
\-ASME B16.9-\	(1993) Factory-Made Wrought Steel Buttwelding Fittings
\-ASME B16.11-\	(1991) Forged Fittings, Socket-Welding and Threaded
\-ASME B16.21-\	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
\-ASME B16.34-\	(1988) Valves - Flanged, Threaded, and Welding End
\-ASME B16.40-\	(1985; R 1994) Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems
\-ASME B31.8-\	(1995) Gas Transmission and Distribution Piping Systems
\-ASME BPV VIII Div 1-\	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

CODE OF FEDERAL REGULATIONS (CFR)

\-49 CFR 192-\	Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

\-MSS SP-25-\	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions

NACE INTERNATIONAL (NACE)

\-NACE RP0185-\	(1985) Extruded, Polyolefin Resin Coating Systems for Underground or Submerged Pipe
\-NACE RP0274-\	(1993) High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

\-SSPC Paint 21-\	(1991) White or Colored Silicone Alkyd Paint

\-SSPC Paint 25-\	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
\-SSPC Paint 101-\	(1991) Aluminum Alkyd Paint
\-SSPC Paint 104-\	(1991) White or Tinted Alkyd Paint
\-SSPC SP 1-\	(1982) Solvent Cleaning
\-SSPC SP 3-\	(1995) Power Tool Cleaning
\-SSPC SP 6-\	(1994) Commercial Blast Cleaning
\-SSPC SP 7-\	(1994) Brush-Off Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

\-UL-06-\	(1996) Gas and Oil Equipment Directory

1.2 GENERAL REQUIREMENTS

1.2.1 *Welding Steel Piping*\

Welding and nondestructive testing procedures for pressure piping are specified in Section \=15052=\ WELDING, PRESSURE PIPING. Structural members shall be welded in accordance with Section \=05055=\ WELDING, STRUCTURAL.

1.2.2 *Jointing Polyethylene and Fiberglass Piping*\

Piping shall be joined by performance qualified joiners using qualified procedures in accordance with \-AGA-01-\. Manufacturer's prequalified joining procedures shall be used. Joints shall be inspected by an inspector qualified in the joining procedures being used and in accordance with \-AGA-01-\. Joiners and inspectors shall be qualified at the jobsite by a person who has been trained and certified by the manufacturer of the pipe, to train and qualify joiners and inspectors in each joining procedure to be used on the job. Training shall include use of equipment, explanation of the procedure, and successfully making joints which pass tests specified in \-AGA-01-\. The Contracting Officer shall be notified at least 24 hours in advance of the date to qualify joiners and inspectors.

1.2.3 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Valves, flanges, and fittings shall be marked in accordance with \-MSS SP-25-\.

1.2.4 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.2.5 Handling

Pipe and components shall be handled carefully to ensure a sound, undamaged condition. Particular care shall be taken not to damage pipe coating. No pipe or material of any kind shall be placed inside another pipe or fitting after the coating has been applied, except as specified in paragraph INSTALLATION. Plastic pipe shall be handled in conformance with \-AGA-01-\.

1.3 SUBMITTALS

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

SD-04 Drawings\

Pipe, Fittings, and Associated Materials\; *FIO*\.

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

SD-07 Schedules\

Equipment and Materials\; *FIO*\.

A complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions, including, but not limited to the following:

a. Dielectric Unions and Flange Kits.

b. Meters.

c. Pressure Reducing Valves.

d. Regulators.

e. Emergency Gas Supply Connection.

Spare Parts Data\; *FIO*\.

Spare parts lists for each different item of material and equipment specified, after approval of the detail drawings and not later than 3 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Notification\; *FIO*\.

Notification of the Contractor's schedule for making connections to existing gas lines, at least 10 days in advance.

SD-08 Statements\

Welding Steel Piping\; *FIO*\.

A copy of qualified welding procedures along with a list of names and identification symbols of performance qualified welders and welding operators.

Jointing Polyethylene and Fiberglass Piping\; *GA*\.

A copy of qualified jointing procedures, training procedures, qualifications of trainer, and training test results for joiners and inspectors.

Connection and Abandonment Procedures\; *GA*\.

A copy of procedures for gas line tie in, hot taps, abandonment/removal or demolition, purging, and plugging as applicable in accordance with \-ASME B31.8-\.

SD-13 Certificates\

Utility Work\; *FIO*\.

Certification from the Operating Agency/Utility Company that work for which the Utility is responsible has been completed.

Training\; *FIO*\.

A copy of each inspector's and jointer's training certificate with respective test results.

SD-19 Operation and Maintenance Manuals\

Gas Distribution System\; *FIO*\.

Six copies, in booklet form and indexed, of site specific natural gas operation and maintenance manual for each gas distribution system including system operation, system maintenance, equipment operation, and equipment maintenance manuals described below. If operation and maintenance manuals are provided in a common volume, they shall be clearly differentiated and separately indexed.

The System Operation Manual shall include but not be limited to the following:

a. Maps showing piping layout and locations of all system valves and gas line markers.

b. Step-by-step procedures required for system startup, operation, and shutdown. System components and equipment shall be indexed to the gas maps.

c. Isolation procedures and valve operations to shut down or isolate each section of the system. Valves and other system components shall be indexed to the gas maps.

d. Descriptions of Site Specific Standard Operation Procedures including permanent and temporary pipe repair procedures, system restart and test procedures for placing repaired lines back in service, and procedures for abandoning gas piping and system components.

e. Descriptions of Emergency Procedures including: isolation procedures including required valve operations with valve locations indexed to gas map, recommended emergency equipment, checklist for major emergencies and procedures for connecting emergency gas supply.

The Equipment Operation Manual shall include but not be limited to detail drawings, equipment data, and manufacturer supplied operation manuals for all equipment, valves and system components.

The System Maintenance Manuals shall include but not be limited to:

a. Maintenance check list for entire gas distribution system.

b. Descriptions of site specific standard maintenance procedures.

c. Maintenance procedures for installed cathodic protection systems.

d. Piping layout, equipment layout, and control diagrams of the systems as installed.

e. Identification of pipe materials and manufacturer by location, pipe repair procedures, and jointing procedures at transitions to other piping materials or piping from different manufacturer.

The Equipment Maintenance Manuals shall include but not be limited to the following:

a. Identification of valves and other equipment by materials, manufacturer, vendor identification and location.

b. Maintenance procedures and recommended maintenance tool kits for all valves and equipment.

c. Recommended repair methods, either field repair, factory repair, or whole-item replacement for each valve component or piece of equipment or component item.

d. Routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide.

PART 2 - PRODUCTS

2.1 *PIPE, FITTINGS, AND ASSOCIATED MATERIALS*\

2.1.1 Steel Pipe

Steel pipe shall conform to \-ASTM A 53-\, Grade A or B, Type E or S, Schedule 40; or \-API Spec 5L-\ seamless or electric resistance welded, Schedule 40, black steel pipe as specified in \-ASME B31.8-\. Furnace buttwelded pipe may be used in sizes 1-1/2 inches and smaller.

2.1.2 Small Fittings

Fittings 1-1/2 inches and smaller shall conform to \-ASME B16.11-\.

2.1.3 Fittings, 2 Inches and Larger

Pipe flanges and flanged fittings including bolts, nuts, and bolt patterns shall be in accordance with \-ASME B16.5-\, Class 150. Buttweld fittings shall be in accordance with \-ASME B16.9-\. Weld neck flanges shall be used.

2.1.4 Steel Forged Branch Connections

Connections shall conform to \-ASTM A 181-\, Class 60, carbon steel.

2.1.5 Flange Gaskets

Gaskets shall be non-asbestos compressed material in accordance with \-ASME B16.21-\, 1/16 inch minimum thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with nitrile butadiene rubber (NBR), or glass fibers bonded with polytetrafluorethylene, suitable for maximum 600 degrees F service and meeting applicable requirements of \-ASME B31.8-\.

2.1.6 Pipe Threads

Pipe threads shall conform to \-ASME B1.20.1-\.

2.1.7 Polyethylene Pipe, Tubing, Fittings and Joints

Polyethylene pipe, tubing, fittings and joints shall conform to \-ASTM D 3350-\ and \-ASTM D 2513-\, pipe designations PE 2406 and PE 3408, rated [AM#1] SDR 11 (minimum) as specified in \-ASME B31.8-\. Pipe sections shall be marked as required by \-ASTM D 2513-\. Butt fittings shall conform to \-ASTM D 3261-\ and socket fittings shall conform to \-ASTM D 2683-\. Fittings shall match the service rating of the pipe. Minimum wall thickness shall be in accordance with ASME B31.8 table 842.31(c).

2.1.8 Fiberglass Pipe, Fittings and Adhesive

Fiberglass pipe, fittings and adhesive shall conform to \-ASTM D 2517-\. Pipe sections shall be marked as required by \-ASTM D 2517-\. Minimum wall thickness shall be in accordance with ASME B31.8 table 842.32 (c).

2.1.9 Sealants for Steel Pipe Threaded Joints

2.1.9.1 Sealing Compound

Joint sealing compound shall be as listed in \-UL-06-\, Class 20 or less.

2.1.9.2 Tape

Polytetrafluoroethylene tape shall conform to \-ASTM D 3308-\.

2.1.10 Identification

Pipe flow markings and metal tags for each valve, meter, and regulator shall be provided as required by the Contracting Officer.

2.1.11 Insulating Joint Materials

Insulating joint materials shall be provided between flanged or threaded metallic pipe systems where shown to isolate galvanic or electrolytic action.

2.1.11.1 Threaded Joints

Joints for threaded pipe shall be steel body nut type dielectric type unions with insulating gaskets.

2.1.11.2 Flanged Joints

Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts and insulating washers for flange nuts.

2.1.12 Gas Transition Fittings

Gas transition fittings shall be manufactured steel fittings approved for jointing steel and polyethylene or fiberglass pipe. Approved transition fittings are those that conform to \-AGA-01-\ requirements for transition fittings.

2.2 VALVES

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

2.2.1 Steel Valves

Steel valves 1-1/2 inches and smaller installed underground shall conform to \-ASME B16.34-\, carbon steel, socket weld ends, with square wrench operator adaptor. Steel valves 1-1/2 inches and smaller installed aboveground shall conform to \-ASME B16.34-\, carbon steel, socket weld or threaded ends with handwheel or wrench operator. Steel valves 2 inches and larger installed underground shall conform to \-API Spec 6D-\, carbon steel, buttweld ends, Class 150 with square wrench operator adaptor. Steel valves 2 inches and larger installed aboveground shall conform to \-API Spec 6D-\, carbon steel, buttweld or flanged ends, Class 150 with handwheel or wrench operator.

2.2.2 Steel Valve Operators

Valves 8 inches and larger shall be provided with worm or spur gear operators, totally enclosed, grease packed, and sealed. The operators shall have Open and Closed stops and position indicators. Locking feature

shall be provided where indicated. Wherever the lubricant connections are not conveniently accessible, suitable extensions for the application of lubricant shall be provided. Valves shall be provided with lubricant compatible with gas service.

2.2.3 Polyethylene Valves

Polyethylene valves shall conform to \-ASME B16.40-\. Polyethylene [AM#1] ball valves, in sizes 1/2 inch to 6 inches,[AM#1] shall be used with polyethylene distribution and service lines, in lieu of steel valves, for underground installation only.

2.3 PRESSURE REGULATORS

Regulators shall have ferrous bodies, shall provide backflow and vacuum protection, and shall be designed to meet the pressure, load and other service conditions.

2.3.1 Gas Main Regulators

Pressure regulators for main distribution lines, supplied from a source of gas which is at a higher pressure than the maximum allowable operating pressure for the system, and shall be equipped with pressure regulating devices of adequate capacity. In addition to the pressure regulating devices, a suitable method shall be provided to prevent overpressuring of the system in accordance with \-ASME B31.8-\. Suitable protective devices are as follows:

a. Spring-loaded relief valve meeting the provisions of \-ASME BPV VIII Div 1-\.

b. Pilot-loaded back pressure regulator used as relief valve, so designed that failure of the pilot system will cause the regulator to open.

c. Weight-loaded relief valves.

d. Monitoring regulator installed in series with the primary pressure regulator.

e. Series regulator installed upstream from the primary regulator, set to limit the pressure on the inlet of the primary regulator continuously to the maximum allowable operating pressure of the system, or less.

f. Automatic shutoff device installed in series with the primary regulator, set to shut off when the pressure on the distribution system reaches the maximum allowable operating pressure of the system, or less. This device shall remain closed until manually reset.

g. Spring-loaded, diaphragm type relief valves.

2.3.2 Service Line Regulators

Pressure regulators for individual service lines shall have ferrous bodies. Regulator shall be capable of reducing distribution line pressure to pressures required for users. Regulators shall be provided where gas will be distributed at pressures in excess of 10 inches of water column.

Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulators for liquified petroleum gas shall be adjusted to 10 to 12 inches of water column. Pressure relief for liquified petroleum gas shall be set at 16 inches of water column. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Regulator shall have a self contained service regulator. Regulator pipe connections shall not exceed 2 inch size.

2.4 METERS

Meters shall conform to \-ANSI B109.2-\and \MS MIL-M-18294, Style B\. Meters shall be pipe mounted and be provided with a strainer immediately upstream. Meters shall be provided with over-pressure protection as specified in \-ASME B31.8-\ tamper-proof protection frost protection fungus-proof protection. Meters shall be suitable for accurately measuring and handling gas at pressures, temperatures, and flow rates indicated. Meters shall have a pulse switch initiator capable of operating up to speeds of 500 pulses per minute with no false pulses and shall require no field adjustments. Initiators shall provide the maximum number of pulses up to 500 per minute that is obtainable from the manufacturer. It shall provide not less than one pulse per 100 cubic feet of gas.

2.5 EMERGENCY GAS SUPPLY CONNECTION

The emergency gas supply connection shall consist of piping (same size as service line) and accessories that will enable a portable, commercial-sized gas cylinder system to be connected to the gas piping system. This connection shall be capped to prevent gas leakage with a lockable manual valve located to be capable of shutting off flow. The entire assembly should be contained in a weatherproof, lockable box. The box shall contain permanently installed written instructions stating the type and pressure of the gas allowed to be connected to the line. The instructions shall also indicate and provide specific instruction for testing of the integrity of the building's gas system with an inert gas before the fuel gas connection is made. A subplate shall be provided in the box that is required to be unbolted to gain access to the connection. The subplate shall contain a warning regarding the potential consequences of using gas other than that specified or of failing to test system integrity before hooking up emergency fuel supply.

2.6 PROTECTIVE COVERING MATERIALS

2.6.1 Thermoplastic Resin Coating System

Continuously extruded polyethylene and adhesive coating system materials shall conform to \-NACE RP0185-\, Type A.

2.7 TELEMETERING OR RECORDING GAUGES

Each distribution system supplied by more than one district pressure regulating station shall be equipped with telemetering or recording pressure gauges to indicate the gas pressure in the district line.

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILLING

Earthwork shall be as specified in Section \=02222=\ EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2 GAS MAINS

Pipe for gas mains shall be polyethylene or fiberglass. Polyethylene or fiberglass mains shall not be installed aboveground.

3.3 SERVICE LINES AND EMERGENCY GAS SUPPLY CONNECTION

Service lines shall be constructed of materials specified for gas mains and shall extend from a gas main to and including the point of delivery within 5 feet of the building. The point of delivery is the meter set assembly. The service lines shall be connected to the gas mains as indicated. Where indicated, service line shall be provided with an isolation valve of the same size as the service line. The service lines shall be as short and as straight as practicable between the point of delivery and the gas main and shall not be bent or curved laterally unless necessary to avoid obstructions or otherwise permitted. Service lines shall be laid with as few joints as practicable using standard lengths of pipe. Shorter lengths shall be used only for closures. Polyethylene or fiberglass service lines shall not be installed aboveground except as permitted in \-ASME B31.8-\.

3.4 WORKMANSHIP AND DEFECTS

Pipe, tubing, and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and blown free of chips and scale. Defective pipe, tubing, or fittings shall be replaced and shall not be repaired.

3.5 PROTECTIVE COVERING

3.5.1 Protective Covering for Underground Steel Pipe

Except as otherwise specified, protective coverings shall be applied mechanically in a factory or field plant especially equipped for the purpose. Valves and fittings that cannot be coated and wrapped mechanically shall have the protective covering applied by hand, preferably at the plant that applies the covering to the pipe. Joints shall be coated and wrapped by hand. Hand coating and wrapping shall be done in a manner and with materials that will produce a covering equal in thickness to that of the covering applied mechanically.

3.5.1.1 Thermoplastic Resin Coating System

The coating system shall conform to \-NACE RP0185-\, Type A. The exterior of the pipe shall be cleaned to a commercial grade blast cleaning finish in accordance with \-SSPC SP 6-\. Adhesive compound shall be applied to the

pipe. Immediately after the adhesive is applied, a seamless tube of polyethylene shall be extruded over the adhesive to produce a bonded seamless coating. The nominal thickness of the pipe coating system shall be 10 mils (plus or minus 10 percent) of adhesive and 40 mils (plus or minus 10 percent) of polyethylene for pipes up to 16 inches in diameter. For pipes 18 inches and larger in diameter, the pipe coating system thickness shall be 10 mils (plus or minus 10 percent) adhesive and 60 mils (plus or minus 10 percent) polyethylene. Joint coating and field repair material shall be applied as recommended by the coating manufacturer and shall be one of the following:

a. Heat shrinkable polyethylene sleeves.

b. Polyvinyl chloride pressure-sensitive adhesive tape.

c. High density polyethylene/bituminous rubber compound tape.

The coating system shall be inspected for holes, voids, cracks, and other damage during installation.

3.5.1.2 Inspection of Pipe Coatings

Any damage to the protective covering during transit and handling shall be repaired before installation. After field coating and wrapping has been applied, the entire pipe shall be inspected by an electric holiday detector with impressed current set at a value in accordance with \-NACE RP0274-\ using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. All holidays in the protective covering shall be repaired immediately upon detection. The Contracting Officer reserves the right to inspect and determine the suitability of the detector. Labor, materials, and equipment necessary for conducting the inspection shall be furnished by the Contractor.

3.5.2 Protective Covering for Aboveground Piping Systems

Finish painting shall conform to the applicable paragraphs of Section \=09900=\ PAINTING, GENERAL and as follows:

3.5.2.1 Ferrous Surfaces

Shop primed surfaces shall be touched up with ferrous metal primer same type paint as the shop primer. Surfaces that have not been shop primed shall be solvent-cleaned in accordance with \-SSPC SP 1-\. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be mechanically cleaned by power wire brushing in accordance with \-SSPC SP 3-\ or brush-off blast cleaned in accordance with \-SSPC SP 7-\ and primed with ferrous metal primer in accordance with \-SSPC Paint 25-\. Primed surfaces shall be finished with two coats of exterior alkyd paint conforming to \-SSPC Paint 104-\.

3.5.2.2 Nonferrous Surfaces

Nonferrous surfaces shall not be painted.

3.5.3 Protective Covering for Piping in Valve Boxes and Manholes

Piping in valve boxes or manholes shall receive protective coating as specified for underground steel pipe.

3.6 INSTALLATION

Gas distribution system and equipment shall be installed in conformance with the manufacturer's recommendations and applicable sections of \-ASME B31.8-\, \-AGA-01-\ and \-49 CFR 192-\. Abandoning existing gas piping shall be done in accordance with \-ASME B31.8-\. Pipe shall be cut without damaging the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. On steel pipe 6 inches and larger, an approved gas-cutting-and-beveling machine may be used. Cutting of plastic pipe shall be in accordance with \-AGA-01-\. Valve installation in plastic pipe shall be designed to protect the plastic pipe against excessive torsional or shearing loads when the valve is operated and from other stresses which may be exerted through the valve or valve box.

3.6.1 \+Installing Pipe Underground+\

Gas mains and service lines shall be graded as indicated. Joints in steel pipe shall be welded except as otherwise permitted for installation of valves. Mains shall have 24 inch minimum cover; service lines shall have 18 inch minimum cover; and both mains and service lines shall be placed on firmly compacted select material for the full length. Where indicated, the main shall be encased, bridged, or designed to withstand any anticipated external loads as specified in \-ASME B31.8-\. The encasement material shall be standard weight black steel pipe with a protective coating as specified. The pipe shall be separated from the casing by insulating spacers and sealed at the ends with casing bushings. Trench shall be excavated below pipe grade, bedded with bank sand, and compacted to provide full-length bearing. Laying the pipe on blocks to produce uniform grade will not be permitted. The pipe shall be clean inside before it is lowered into the trench and shall be kept free of water, soil, and all other foreign matter that might damage or obstruct the operation of the valves, regulators, meters, or other equipment. When work is not in progress, open ends of pipe or fittings shall be securely closed by expandable plugs or other suitable means. Minor changes in line or gradient of pipe that can be accomplished through the natural flexibility of the pipe material without producing permanent deformation and without overstressing joints may be made when approved. Changes in line or gradient that exceed the limitations specified shall be made with fittings. When cathodic protection is furnished, electrically insulated joints or flanges shall be provided. When polyethylene or fiberglass piping is installed underground, foil backed magnetic tape shall be placed above the pipe to permit locating with a magnetic detector. After laying of pipe and testing, trench shall be backfilled in accordance with Section \=02222=\ EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITY SYSTEMS.

3.6.2 Installing Pipe Aboveground

Aboveground piping shall be protected against dirt and other foreign matter as specified for underground piping. Joints in steel pipe shall be welded;

however joints in pipe 1-1/2 inches in diameter and smaller may be threaded; joints may also be threaded to accommodate the installation of valves. Flanges shall be of the weld neck type to match wall thickness of pipe.

3.7 PIPE JOINTS

Pipe joints shall be designed and installed to effectively sustain the longitudinal pullout forces caused by the contraction of piping or superimposed loads.

3.7.1 Threaded Steel Joints

Threaded joints in steel pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or polytetrafluoroethylene tape applied to the male threads only. Caulking of threaded joints to stop or prevent leaks will not be permitted.

3.7.2 Welded Steel Joints

Gas pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to \-ASME B31.8-\. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.

3.7.3 Polyethylene and Fiberglass Pipe Jointing Procedures

Jointing procedures shall conform to \-AGA-01-\. Indiscriminate heat fusion joining of plastic pipe or fittings made from different polyethylene resins by classification or by manufacturer shall be avoided if other alternative joining procedures are available. If heat fusion joining of dissimilar polyethylenes is required, special procedures are required. The method of heat fusion joining dissimilar polyethylene resins shall be tested in accordance with paragraph TESTS, subparagraph Destructive Tests of Plastic Pipe Joints.

3.7.4 Connections Between Metallic and Plastic Piping

Connections shall be made only outside, underground, and with approved transition fittings.

3.8 VALVE BOXES

Valve boxes of cast iron not less than 3/16 inch thick shall be installed at each underground valve except where concrete or other type of housing is indicated. Valve boxes shall be provided with locking covers that require a special wrench for removal. Wrench shall be furnished for each box. The

word "gas" shall be cast in the box cover. When the valve is located in a roadway, the valve box shall be protected by a suitable concrete slab at least 3 square feet. When in a sidewalk, the top of the box shall be in a concrete slab 2 feet square and set flush with the sidewalk. Boxes shall be adjustable extension type with screw or slide-type adjustments. Valve boxes shall be separately supported, not resting on the pipe, so that no traffic loads can be transmitted to the pipe. Valves shall only be located in valve boxes or inside of buildings.

3.9 PRESSURE REGULATOR INSTALLATION

3.9.1 Service Line Regulators

A shutoff valve, meter set assembly, and service regulator shall be installed on the service line outside the building, 18 inches above the ground on the riser. An insulating joint shall be installed on the inlet side of the meter set assembly and service regulator and shall be constructed to prevent flow of electrical current. A 3/8 inch tapped fitting equipped with a plug shall be provided on both sides of the service regulator for installation of pressure gauges for adjusting the regulator. All service regulator vents and relief vents shall terminate in the outside air in rain and insect resistant fittings. The open end of the vent shall be located where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding.

3.10 METER INSTALLATION

Meters shall be installed in accordance with \-ASME B31.8-\. Permanent gas meters shall be installed with provisions for isolation and removal for calibration and maintenance, and shall be suitable for operation in conjunction with an energy monitoring and control system.

3.11 CONNECTIONS TO EXISTING LINES

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

3.12 CATHODIC PROTECTION

Cathodic protection shall be provided for all metallic gas piping installed underground and shall be installed as specified in Section [AM#1] \=13110=\ CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

3.13 \+TESTS+\

3.13.1 Destructive Tests of Plastic Pipe Joints

Each day, prior to making polyethylene heat fusion joints or fiberglass adhesive joints, a joint of each size and type to be installed that day shall be made by each person performing joining of plastic pipe that day and destructively tested. At least 3 longitudinal straps shall be cut from each joint. Each strap shall be visually examined, shall not contain voids or discontinuities on the cut surfaces of the joint area, and shall be deformed by bending, torque, or impact, and if failure occurs, it must not

initiate in the joint area. If a joint fails the visual or deformation test, the qualified joiner who made that joint shall not make further field joints in plastic pipe on this job until that person has been retrained and requalified. The results of the destructive tests shall be recorded to include the date and time of the tests, size and type of the joints, ambient conditions, fusion iron temperature and names of inspectors and joiners.

3.13.2 Pressure and Leak Tests

The system of gas mains and service lines shall be tested after construction and before being placed in service using air as the test medium. The normal operating pressure for the system is 30 psig. The test pressure is 50 psig. Prior to testing the system, the interior shall be blown out, cleaned and cleared of all foreign materials. All meters, regulators, and controls shall be removed before blowing out and cleaning and reinstalled after clearing of all foreign materials. Testing of gas mains and service lines shall be done with due regard for the safety of employees and the public during the test. Persons not working on the test operations shall be kept out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. Joints in sections shall be tested prior to backfilling when trenches must be backfilled before the completion of other pipeline sections. The test shall continue for at least 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the pipe has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. The temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship T(1)P(2)=T(2)P(1), in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial and final readings. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. The testing instruments shall be approved by the Contracting Officer. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain safety precautions for air pressure testing at all times during the tests.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02720

STORM-DRAINAGE SYSTEMS

06/91

PART
1 - GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

\-ACI 346/346R-\	(1990) Standard Specification for Cast-in-Place Nonreinforced Concrete Pipe and Recommendations

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

\-AASHTO HB-16-\	(1996) Standard Specifications for Highway Bridges
\-AASHTO M 167-\	(1994) Corrugated Steel Structural Plate, Zinc Coated, for Field Bolted Pipe
\-AASHTO M 190-\	(1988) Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches
\-AASHTO M 198-\	(1994) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
\-AASHTO M 219-\	(1992) Aluminum Alloy Structural Plate for Field Bolted Conduits
\-AASHTO M 243-\	(1994) Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches
\-AASHTO M 294-\	(1994) Corrugated Polyethylene Pipe, 305- to 915- mm 12-to 36 in. Diameter
\-AASHTO M 304-\	(1994) Poly(Vinyl Chloride) (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)

\-AREA-03-\	(1994) Manual for Railway Engineering (Fixed Properties): Chapter 1, Roadway and Ballast

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 48-\	(1994a) Gray Iron Castings
\-ASTM A 123-\	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
\-ASTM A 444-\	(1989) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Storm Sewer and Drainage Pipe
\-ASTM A 536-\	(1984; R 1993) Ductile Iron Castings
\-ASTM A 716-\	(1995) Ductile Iron Culvert Pipe
\-ASTM A 742-\	(1993) Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe
\-ASTM A 760-\	(1995a) Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
\-ASTM A 762-\	(1995) Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
\-ASTM A 798-\	(1994) Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
\-ASTM A 807-\	(1996) Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications
\-ASTM A 849-\	(1994) Post Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
\-ASTM B 26-\	(1996) Aluminum-Alloy Sand Castings
\-ASTM B 745-\	(1995) Corrugated Aluminum Pipe for Sewers and Drains
\-ASTM C 12-\	(1995) Installing Vitrified Clay Pipe Lines
\-ASTM C 14-\	(1995) Concrete Sewer, Storm Drain, and Culvert Pipe
\-ASTM C 32-\	(1993) Sewer and Manhole Brick (Made from Clay or Shale)
\-ASTM C 55-\	(1995) Concrete Building Brick
\-ASTM C 62-\	(1996) Building Brick (Solid Masonry Units Made from Clay or Shale)
\-ASTM C 76-\	(1995) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
\-ASTM C 139-\	(1995) Concrete Masonry Units for Construction of Catch Basins and Manholes

\-ASTM C 231-\	(1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
\-ASTM C 270-\	(1996a) Mortar for Unit Masonry
\-ASTM C 425-\	(1995) Compression Joints for Vitrified Clay Pipe and Fittings
\-ASTM C 443-\	(1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
\-ASTM C 478-\	(1994) Precast Reinforced Concrete Manhole Sections
\-ASTM C 506-\	(1995) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
\-ASTM C 507-\	(1995a) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
\-ASTM C 655-\	(1994) Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
\-ASTM C 700-\	(1996) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
\-ASTM C 789-\	(1994) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
\-ASTM C 850-\	(1994) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 Ft. of Cover Subjected to Highway Loadings
\-ASTM C 877-\	(1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe
\-ASTM D 1056-\	(1991) Flexible Cellular Materials - Sponge or Expanded Rubber
\-ASTM D 1171-\	(1994) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
\-ASTM D 1557-\	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
\-ASTM D 1751-\	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
\-ASTM D 1752-\	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

\-ASTM D 1784-\	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
\-ASTM D 2167-\	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
\-ASTM D 2321-\	(1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
\-ASTM D 2922-\	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 3017-\	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 3034-\	(1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
\-ASTM D 3212-\	(1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
\-ASTM D 3350-\	(1993) Polyethylene Plastics Pipe and Fittings Materials
\-ASTM F 477-\	(1995) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
\-ASTM F 679-\	(1995) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
\-ASTM F 714-\	(1994) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
\-ASTM F 794-\	(1995a) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
\-ASTM F 894-\	(1995) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
\-ASTM F 949-\	(1994) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

1.2 SUBMITTALS

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

SD-06 Instructions\

Placing Pipe\; *FIO*\.

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-13 Certificates\

Resin Certification\; *FIO*\.

Pipeline Testing\; *FIO*\.

Hydrostatic Test on Watertight Joints\; *FIO*\.

Determination of Density\; *FIO*\.

Frame and Cover for Gratings\; *FIO*\.

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed. Certification on the ability of frame and cover or gratings to carry the imposed live load.

SD-14 Samples\

Pipe for Culverts and Storm Drains\; *FIO*\.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Gasket materials and plastic materials shall be protected from exposure to the direct sunlight over extended periods.

1.3.2 Handling

Materials shall be handled in such a manner as to ensure delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 - PRODUCTS

2.1 *PIPE FOR CULVERTS AND STORM DRAINS*\

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

\-ASTM C 76-\, Class III, IV or V, or \-ASTM C 655-\, 2000 or 3000 D-Load.

2.1.1.1 Reinforced Arch Culvert and Storm Drainpipe

\-ASTM C 506-\, Class A-III or A-IV.

2.1.1.2 Reinforced Elliptical Culvert and Storm Drainpipe

\-ASTM C 507-\. Horizontal elliptical pipe shall be Class HE-III or HE-IV. Vertical elliptical pipe shall be Class VE-III, VE-IV, VE-V or VE-VI.

2.1.1.3 Nonreinforced Pipe

\-ASTM C 14-\, Class 2 or 3.

2.1.2 Corrugated Steel Pipe

2.1.2.1 Fully Bituminous Coated, Fully Paved

\-AASHTO M 190-\ Type D and \-ASTM A 760-\ zinc coated, aluminum coated or aluminum-zinc alloy coated Type I, II, IR or IIR corrugated steel pipe with annular or helical corrugations.

2.1.2.2 Concrete-Lined

\-ASTM A 760-\ zinc coated, aluminum coated or aluminum-zinc alloy coated Type I or IR corrugated steel pipe with annular or helical corrugations and a concrete lining in accordance with \-ASTM A 849-\. The concrete lining shall be not less than 3/8 inch over the inside crest of the corrugation.

2.1.2.3 Precoated, Fully Paved

\-ASTM A 762-\ Type I, II, IR or IIR corrugated steel pipe and \-AASHTO M 190-\ Type D (modified), fully paved only, fabricated from \-ASTM A 742-\ Grade 10/10 precoated sheet and annular or helical corrugations.

2.1.3 Corrugated Aluminum Alloy Pipe

2.1.4 PVC Pipe

The pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe in accordance with \-AASHTO M 304-\, shall be submitted prior to installation of the pipe.

2.1.4.1 Type PSM PVC Pipe

\-ASTM D 3034-\, Type PSM, maximum SDR 35, produced from PVC certified by the compounder as meeting the requirements of \-ASTM D 1784-\, minimum cell class 12454-B.

2.1.4.2 Profile PVC Pipe

\-ASTM F 794-\, Series 46, produced from PVC certified by the compounder as meeting the requirements of \-ASTM D 1784-\, minimum cell class 12454-B.

2.1.4.3 Smooth Wall PVC Pipe

\-ASTM F 679-\ produced from PVC certified by the compounder as meeting the requirements of \-ASTM D 1784-\, minimum cell class 12454-B.

2.1.4.4 Corrugated PVC Pipe

\-ASTM F 949-\ produced from PVC certified by the compounder as meeting the requirements of \-ASTM D 1784-\, minimum cell class 12454-B.

2.1.5 PE Pipe

The pipe manufacturer's resin certification indicating the cell classification of PE used to manufacture the pipe shall be submitted prior to installation of the pipe. The minimum cell classification for polyethylene plastic shall apply to each of the seven primary properties of the cell classification limits in accordance with \-ASTM D 3350-\.

2.1.5.1 Smooth Wall PE Pipe

\-ASTM F 714-\, maximum DR of 21 for pipes 3 to 24 inches in diameter and maximum DR of 26 for pipes 26 to 48 inches in diameter. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of \-ASTM D 3350-\, minimum cell class 335434C.

2.1.5.2 Corrugated PE Pipe

\-AASHTO M 294-\, Type S, produced from PE certified by the resin producer as meeting the requirements of \-ASTM D 3350-\, minimum cell class 315412C or 324420C. Pipe walls shall have the following properties:

Nominal Size (in.)	Minimum Wall Area (square in/ft)	Minimum Moment of Inertia of Wall Section (in to the 4th/in)
12	1.50	0.024
15	1.91	0.053
18	2.34	0.062
24	3.14	0.116
30	3.92	0.163
36	4.50	0.222

2.1.5.3 Profile Wall PE Pipe

\-ASTM F 894-\, RSC 160, produced from PE certified by the resin producer as meeting the requirements of \-ASTM D 3350-\, minimum cell class 334433C. Pipe walls shall have the following properties:

		Minimum Moment Of Inertia of Wall Section (in to the 4th/in)	
Nominal Size (in.)	Minimum Wall Area (square in/ft)	Cell Class 334433C	Cell Class 335434C
18	2.96	0.052	0.038

21	4.15	0.070	0.051
24	4.66	0.081	0.059
27	5.91	0.125	0.091
30	5.91	0.125	0.091
33	6.99	0.161	0.132
36	8.08	0.202	0.165
42	7.81	0.277	0.227
48	8.82	0.338	0.277

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of \-ASTM A 444-\.

2.2.2 Precast Reinforced Concrete Box

For highway loadings with 2 feet of cover or more or subjected to dead load only, \-ASTM C 789-\; for less than 2 feet of cover subjected to highway loading, \-ASTM C 850-\.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 3000 psi concrete under Section \=03300=\ CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with \-ASTM C 231-\. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to \-ASTM D 1751-\, or \-ASTM D 1752-\, or shall be resin-impregnated fiberboard conforming to the physical requirements of \-ASTM D 1752-\.

2.3.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to \-ASTM C 270-\, Type M, except the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 6 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.3.3 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to \-ASTM C 478-\. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure.

2.3.4 *Frame and Cover for Gratings*

Frame and cover for gratings shall be cast gray iron, \-ASTM A 48-\, Class 35B; cast ductile iron, \-ASTM A 536-\, Grade 65-45-12; or cast aluminum, \-ASTM B 26-\, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

2.3.5 Joints

2.3.5.1 Deleted. [AM#1]

2.3.5.2 External Sealing Bands

Requirements for external sealing bands shall conform to \-ASTM C 877-\.

2.3.5.3 Deleted. [AM#1]
2.3.5.4 PVC Plastic Pipes

Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

2.3.5.5 Smooth Wall PE Plastic Pipe

Pipe shall be joined using butt fusion method as recommended by the pipe manufacturer.

2.3.5.6 Corrugated PE Plastic Pipe

Water tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to \-ASTM F 477-\. Soil tight joints shall conform to the requirements in \-AASHTO HB-16-\, Division II, Section 26.4.2.4. (e) for soil tightness and shall be as recommended by the pipe manufacturer.

2.3.5.7 Profile Wall PE Plastic Pipe

Joints shall be gasket or thermal weld type with integral bell in accordance with \-ASTM F 894-\.

2.3.5.8 Ductile Iron Pipe

Couplings and fittings shall be as recommended by the pipe manufacturer.

2.4 STEEL LADDER

Steel ladder shall be provided where the depth of the manhole exceeds 12 feet. These ladders will be not less than 16 inches in width, with 3/4

inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2-1/2 inches wide. Ladders and inserts shall be galvanized after fabrication in conformance with \-ASTM A 123-\.

2.5 DOWNSPOUT BOOTS

Boots used to connect exterior downspouts to the storm-drainage system shall be of gray cast iron conforming to \-ASTM A 48-\, Class 30B or 35B. Shape and size shall be as indicated.

2.6 Deleted. [AM#1]

PART 3 - EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches and for appurtenances and backfilling for culverts and storm drains shall be in accordance with the applicable portions of Section \=02222=\ EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS and Section \=02225=\ EARTHWORK FOR ROADWAYS and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 12 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing where required shall be placed within the trench width as specified. Care shall be taken not to overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures shall be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 8 inches or ½ inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section \=02222=\ EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified

requirements, such removal and replacement shall be performed at no additional cost to the government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making the particular type of joint.

3.2.2 Clay Pipe

Bedding for clay pipe shall be as specified by \-ASTM C 12-\.

3.2.3 Corrugated Metal Pipe

Bedding for corrugated metal pipe and pipe arch shall be in accordance with \-ASTM A 798-\. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, it is recommended to either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape. Bedding for corrugated structural plate pipe shall meet requirements of \-ASTM A 807-\.

3.2.4 Ductile Iron Pipe

Bedding for ductile iron pipe shall be as shown on the drawings.

3.2.5 Plastic Pipe

Bedding for PVC and PE pipe shall meet the requirements of \-ASTM D 2321-\. Bedding, haunching, and initial backfill shall be either Class IB or II material.

3.3 *PLACING PIPE*\

Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to the direct sunlight prior to laying as needed to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed plastic pipe shall not exceed 4.5 percent of the nominal

inside diameter. After backfilling has been completed, the Government may perform a deflection test on the entire length of installed plastic pipeline using a mandrel or other suitable device. Any plastic pipe showing deflections in excess of 4.5 percent shall be removed and replaced at the Contractor's expense. All pipe in place shall be inspected before backfilling, and those pipes damaged during placement shall be removed and replaced.

3.3.1 Concrete, Clay, PVC, Ribbed PVC and Ductile Iron Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.3.2 Elliptical and Elliptical Reinforced Concrete Pipe

Placement shall be so that the manufacturer's reference lines designating the top of the pipe will be within 5 degrees of a vertical plane through the longitudinal axis of the pipe. In all backfilling operations, care shall be taken to prevent damage to or misalignment of the pipe.

3.3.3 Corrugated PE Pipe

Laying shall be with the separate sections joined firmly on a bed shaped to line and grade and shall follow manufacturer's recommendations.

3.3.4 Corrugated Metal Pipe and Pipe Arch

Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Part paved pipe shall be installed so that the centerline of bituminous pavement in the pipe, indicated by suitable markings on the top at each end of the pipe sections, coincides with the specified alignment of pipe. Fully paved steel pipe or pipe arch shall have a painted or otherwise applied label inside the pipe or pipe arch indicating sheet thickness of pipe or pipe arch. Any unprotected metal in the joints shall be coated with bituminous material specified in \-AASHTO M 190-\ or \-AASHTO M 243-\. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During installation, pipe or pipe arch shall be handled with care to preclude damage to the bituminous coating or paving. Prior to placing backfill, damaged areas of coupling bands and pipe shall be given a coating of bituminous material, specified in \-AASHTO M 190-\ or \-AASHTO M 243-\. Pipe on which bituminous coating has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced. Vertical elongation, where indicated, shall be accomplished by factory elongation. Suitable markings or properly placed lifting lugs shall be provided to ensure placement of factory elongated pipe in a vertical plane.

3.3.5 Structural-Plate Steel Pipe, Pipe Arches, and Arches

Structural plate structures shall be installed in accordance with \-ASTM A 807-\. Structural plate shall be assembled in accordance with instructions furnished by the manufacturer. Instructions shall show the position of

each plate and the order of assembly. Bolts shall be tightened progressively and uniformly, starting at one end of the structure after all plates are in place. The operation shall be repeated to ensure that all bolts are tightened to meet the torque requirements of 200 foot-pounds plus or minus 50 foot-pounds. Any power wrenches used shall be checked by the use of hand torque wrenches or long-handled socket or structural wrenches for amount of torque produced. Power wrenches shall be checked and adjusted frequently as needed, according to type or condition, to ensure proper adjustment to supply the required torque.

3.3.6 Structural-Plate Aluminum Pipe, Pipe Arches, and Arches

Structural plate shall be assembled in accordance with instructions furnished by the manufacturer. Instructions shall show the position of each plate and the order of assembly. Bolts shall be tightened progressively and uniformly, starting at one end of the structure after all plates are in place. The operation shall be repeated to ensure that all bolts are torqued to a minimum of 100 foot-pounds on aluminum alloy bolts and a minimum of 150 foot-pounds on galvanized steel bolts. Any power wrenches used shall be checked by the use of hand torque wrenches or long-handled socket or structural wrenches for the amount of torque produced. Power wrenches shall be checked and adjusted as frequently as needed, according to type or condition, to ensure that they are in proper adjustment to supply the required torque.

3.3.7 Multiple Culverts

Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 3 feet apart, whichever is less.

3.3.8 Jacking Pipe Through Fills

Methods of operation and installation for jacking pipe through fills shall conform to requirements specified in Vol. I, Chapter 8 of \-AREA-03-\.

3.4 JOINTS

3.4.1 Concrete and Clay Pipe

3.4.1.1 Cement-Mortar Bell-and-Spigot Joint

The first pipe shall be bedded to the established gradeline, with the bell end placed upstream. The interior surface of the bell shall be carefully cleaned with a wet brush and the lower portion of the bell filled with mortar to such depth as to bring inner surfaces of abutting pipes flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into a bell so that sections are closely fitted. After each section is laid, the remainder of the joint shall be filled with mortar, and a bead shall be formed around the outside of the joint with sufficient additional mortar. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint shall be wrapped or bandaged with cheesecloth to hold mortar in place.

3.4.1.2 Cement-Mortar Oakum Joint for Bell-and-Spigot Pipe

A closely twisted gasket shall be made of jute or oakum of the diameter required to support the spigot end of the pipe at the proper grade and to make the joint concentric. Joint packing shall be in one piece of sufficient length to pass around the pipe and lap at top. This gasket shall be thoroughly saturated with neat cement grout. The bell of the pipe shall be thoroughly cleaned with a wet brush, and the gasket shall be laid in the bell for the lower third of the circumference and covered with mortar. The spigot of the pipe shall be thoroughly cleaned with a wet brush, inserted in the bell, and carefully driven home. A small amount of mortar shall be inserted in the annular space for the upper two-thirds of the circumference. The gasket then shall be lapped at the top of the pipe and driven home in the annular space with a caulking tool. The remainder of the annular space then shall be filled completely with mortar and beveled at an angle of approximately 45 degrees with the outside of the bell. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. Placing of this type of joint shall be kept at least five joints behind laying operations.

3.4.1.3 Cement-Mortar Diaper Joint for Bell-and-Spigot Pipe

The pipe shall be centered so that the annular space is uniform. The annular space shall be caulked with jute or oakum. Before caulking, the inside of the bell and the outside of the spigot shall be cleaned.

a. Diaper Bands: Diaper bands shall consist of heavy cloth fabric to hold grout in place at joints and shall be cut in such lengths that they will extend one-eighth of the circumference of pipe above the spring line on one side of the pipe and up to the spring line on the other side of the pipe. Longitudinal edges of fabric bands shall be rolled and stitched around two pieces of wire. Width of fabric bands shall be such that after fabric has been securely stitched around both edges on wires, the wires will be uniformly spaced not less than 8 inches apart. Wires shall be cut into lengths to pass around pipe with sufficient extra length for the ends to be twisted at top of pipe to hold the band securely in place; bands shall be accurately centered around lower portion of joint.

b. Grout: Grout shall be poured between band and pipe from only the high side of band, until grout rises to the top of band at the spring line of pipe, or as nearly so as possible, on the opposite side of pipe, to ensure a thorough sealing of joint around the portion of pipe covered by the band. Silt, slush, water, or polluted mortar grout forced up on the lower side shall be carefully forced out by pouring and removed.

c. Remainder of Joint: The remaining unfilled upper portion of the joint shall then be filled with mortar and a bead formed around the outside of this upper portion of the joint with a sufficient amount of additional mortar. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind actual laying of pipe. No backfilling around joints shall be done until joints have been fully inspected and approved.

3.4.1.4 Cement-Mortar Tongue-and-Groove Joint

The first pipe shall be bedded carefully to the established gradeline with the groove upstream. A shallow excavation shall be made underneath the

pipe at the joint and filled with mortar to provide a bed for the pipe. The grooved end of the first pipe shall be carefully cleaned with a wet brush, and a layer of soft mortar applied to the lower half of the groove. The tongue of the second pipe shall be cleaned carefully with a wet brush; while in horizontal position, a layer of soft mortar shall be applied to the upper half of the tongue. The tongue end of the second pipe then shall be inserted in the grooved end of the first pipe until mortar is squeezed out on interior and exterior surfaces. Sufficient mortar shall be used to fill the joint completely and to form a bead on the outside.

3.4.1.5 Cement-Mortar Diaper Joint for Tongue-and-Groove Pipe

The joint shall be of the type described for cement-mortar tongue-and-groove joint in this paragraph, except that the shallow excavation directly beneath the joint shall not be filled with mortar until after a gauze or cheesecloth band dipped in cement mortar has been wrapped around the outside of the joint. The cement-mortar bead at the joint shall be at least ½ inch, thick and the width of the diaper band shall be at least 8 inches. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind the actual laying of the pipe. No backfilling around the joints shall be done until the joints have been fully inspected and approved.

3.4.1.6 Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe

Sealing compounds shall follow the recommendation of the particular manufacturer in regard to special installation requirements. Surfaces to receive lubricants, primers, or adhesives shall be dry and clean. Sealing compounds shall be affixed to the pipe not more than 3 hours prior to installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Sealing compounds shall be inspected before installation of the pipe, and any loose or improperly affixed sealing compound shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint with mastic-type sealant, a slight protrusion of the material is not visible along the entire inner and outer circumference of the joint when the joint is pulled up, the pipe shall be removed and the joint remade. After the joint is made, all inner protrusions will be cut off flush with the inner surface of the pipe. If nonmastic-type sealant material is used, the "Squeeze-Out" requirement above shall be waived.

3.4.1.7 Deleted. [AM#1]

3.4.1.8 External Sealing Band Joint for Noncircular Pipe

Surfaces to receive sealing bands shall be dry and clean. Bands shall be installed in accordance with manufacturer's recommendations.

3.4.2 Corrugated Metal Pipe

3.4.2.1 Field Joints

Transverse field joints shall be of such design that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in \-ASTM A 798-\. Suitable

transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 30 inches or larger, shall be filled with a bituminous material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

3.4.2.2 Deleted. [AM#1]

3.4.3 Walls and Headwalls

Construction shall be as indicated.

3.5 STEEL LADDER INSTALLATION

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 6 feet vertically, and shall be so installed as to provide at least 6 inches of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.6 BACKFILLING

3.6.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. [AM#1] <u>This material shall be a granular gravel complying with ASTM D 448 size #6 or other approved material.</u> The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 12 inches above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 6 inches. Tests for density will be made as necessary to ensure conformance to the compaction requirements specified elsewhere in this paragraph. Where it is necessary in the opinion of the Contracting Officer, any sheeting or portions of bracing used shall be left in place and the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.6.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified elsewhere in this paragraph. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 6 inches.

3.6.3 Movement of Construction Machinery

In compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.6.4 Compaction

3.6.4.1 General

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.6.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density (densities) which will be determined as specified in this paragraph.

a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.6.5 \+*Determination of Density*\+\

Testing shall be the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed __ [AM#1] once every 100 linear feet of installation of pipe or fraction there of. Laboratory tests for moisture-density relations shall be made in accordance with \-ASTM D 1557-\ except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with \-ASTM D 2167-\ or \-ASTM D 2922-\. When \-ASTM D 2922-\ is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. \-ASTM D 2922-\ results in a wet unit weight of soil and when using this method \-ASTM D 3017-\ shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in \-ASTM D 3017-\ or \-ASTM D 2922-\. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.7 Deleted. [AM#1]

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02812 - IRRIGATION (SPRINKLER) SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

This section includes the design, performance and related requirements of the irrigation system. Water distribution and service lines not within the system are specified in Section 02660 WATER LINES.

1.2 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 53	(1989a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
ASTM B 32	(1989) Solder Metal.
ASTM B 43	(1988) Seamless Red Brass Pipe, Standard Sizes.
ASTM B 88	(1989) Seamless Copper Water Tube.
ASTM D 1785	(1989) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
ASTM D 2241	(1989) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
ASTM D 2287	(1981; R 1988) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
ASTM D 2464	(1989) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
ASTM D 2466	(1989) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
ASTM D 2564	(1988) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
ASTM D 2774	(1972; R 1983) Underground Installation of Thermostatic Pressure Piping.
ASTM D 2855	(1983) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
ASTM D 3261	(1988a) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

ASTM F 441	(1989) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.26.1M	(1984) Water Hammer Arresters.
ASME B1.2	(1983) Gages and Gaging for Unified Inch Screw Threads.
ASME B16.3	(1985) Malleable Iron Threaded Fittings, Classes 150 and 300.
ASME B16.15	(1985) Cast Bronze Threaded Fittings, Classes 125 and 250.
ASME B16.18	(1984) Cast Copper Alloy Solder Joint Pressure Fittings.
ASME B16.22	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
ASME B40.1	(1985) Gauges - Pressure Indicating Dial Type - Elastic Element.

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1012	(Sep 1978) Backflow Preventers with Intermediate Atmospheric Vent.
ASSE 1013	(Apr 1988) Reduced Pressure Principle Backflow Preventers.
ASSE 1020	(Feb 1989) Pressure Vacuum Breaker, Assembly (Recommended for Outdoor Usage).

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C509	(1987) Resilient-Seated Gate Valves, 3 through 12 NPS, for Water and Sewerage Systems.
AWWA C901	(1988; Errata) Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. Through 3 in., for Water Service.

FEDERAL SPECIFICATIONS (FS)

FS 0-F-506	(Rev C) Flux, Soldering; Paste and Liquid.
FS WW-H-001220	(Basic) Head, Sprinkler, (Underground Connected).
FS WW-S-610	(Rev B; Am 1) Sprinkler, Lawn, (Surface Connected).

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCHR)

FCCHR-01	(Jun 1988; 8th Ed) Manual of Cross-Connection Control.

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves.
MSS SP-85	(1985) Cast Iron Globe and Angle Valves - Flanged and Threaded Ends.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(1988; Rev 1) Industrial Control Devices, Controllers and Assemblies.
NEMA ICS 6	(1988; Rev 1) Enclosures for Industrial Control and Systems.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1993) National Electrical Code.

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-01, Data\

Design Analysis and Calculations\; *GA*\.

As soon as practicable after award of contract and before acquisition of any materials, a layout plan, including calculations, showing proposed sprinkler system and all applicable appurtenances therefor shall be submitted for written approval. Total number and type of heads, number and type of zones, size of piping, valve locations, etc., shall be indicated. Calculations shall include pressure losses to and available pressure for the worst head in each zone, the difference in pressure between first and last heads, and any other calculations necessary to accomplish the requirements of PART 1 paragraph DESIGN CRITERIA.

Spare Parts\; *FIO*\.

Design analyses and pressure calculations verifying that system will provide the irrigation requirements. Spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the field tests. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Framed Instructions\; *GA*\.

Labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the product for normal, safe operation.

Field Training Data\; *FIO*\.

Information describing training to be provided, training aids to be used, samples of training materials to be provided, and schedules and notification of training.

SD-04, Drawings\

Irrigation (Sprinkler) System\; *FIO*\.

Detail drawings for valves, sprinkler heads, backflow preventers, automatic controllers, emitter heads, and water hammer arresters. Drawing shall include of a complete list of equipment and materials, and manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed system layout, type and number of heads and emitters, zone valves, drain pockets, backflow devices, controllers, and mounting details of controllers. As-built Drawings which provide current factual information showing locations of mains, heads, valves, and controllers including deviations from and amendments to the drawings and changes in the work shall be included.

SD-06, Instructions\

Irrigation (Sprinkler) System\; *FIO*\.

Detailed procedures defining the Contractor's provisions for accident prevention, health protection, and other safety precautions for the work to be done.

SD-07, Schedules\

Material, Equipment, and Fixture Lists\; *FIO*\.

As soon as practicable after notice to proceed and before procurement of any products, the Contractor shall submit, along with the design drawings and calculations, a complete list of products to be incorporated in the work. List shall include catalog numbers, cuts, diagrams, and such other descriptive data as may be required by the authorized Government representative.

Zone Operation Schedule\; *FIO*\.

Manuals shall include a schedule of zone operation times and sequence of operations meeting the requirements of PART 1 paragraph PERFORMANCE shall be submitted for approval.

SD-09, Reports\

Field Tests\; *FIO*\.

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of control valves.

SD-13, Certificates\

Irrigation (Sprinkler) System\; *FIO*\.

The material supplier's or equipment manufacturer's statement that the supplied material or equipment meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of material supplier or product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply.

SD-19, Operation and Maintenance Manuals\

Irrigation (Sprinkler) System\; *GA*\.

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set prior to field testing and the remainder upon acceptance. Manuals shall be approved prior to the field training course. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

1.4 DEFINITIONS

1.4.1 Compatible (heads) - delivering an equal amount of water over an equivalent surface area.

1.4.2 Diameter of Coverage - diameter of the surface area receiving water (pertains to full or part circle).

1.4.3 Head

1.4.3.1 Bubbler - special head with adjustable flows for deep watering.

1.4.3.2 Fill-in-heads not located on the basic symmetrical pattern and/or which may not have the same coverage as the heads in the pattern.

1.4.3.3 Last - the head on a zone usually farthest from the zone valve and having the least amount of pressure for operation.

1.4.3.4 Pop-up - spray or rotary head installed flush with the turf, containing a nozzle which rises above the turf when operating.

1.4.3.5 Rotary - head containing a nozzle that rotates, discharging a high velocity water stream.

1.4.3.6 Shrub - spray head designed for installation in or above shrubbery and flowers usually with a small diameter of coverage.

1.4.3.7 Spray - head containing a nozzle that discharges a fine uniform water spray.

1.4.3.8 Strip - spray head designed for watering long, narrow strips of turf or landscaping, usually in a square pattern.

1.4.4 Header - water line leading off from a zone valve; subject to pressure only when zone is operating.

1.4.5 Lateral - water line leading off from a header to a head.

1.4.6 Main - water line under constant pressure, supplying the sprinkler zones; subject to various degrees of water hammer.

1.4.7 Valve

1.4.7.1 Throttle - valve used to regulate flow to a zone.

1.4.7.2 Zone - valve used to activate/terminate flow to a zone.

1.4.8 Zone - a section of heads controlled by one valve.

1.5 GENERAL

The contract drawings indicate extent of the sprinkler system. If any departures from the contract drawings are deemed necessary by the Contractor, details of such departures and reasons therefor shall be submitted in writing as soon as practicable after contract award to the authorized Government representative for written approval.

1.6 DESIGN CRITERIA

1.6.1 General

Observance of the criteria established in this paragraph shall not relieve the installed system of meeting the requirements of PART 1 paragraph: PERFORMANCE.

1.6.1.1 Area Coverage

The limits of the area to be covered and type of irrigation coverage shall be as indicated.

1.6.1.2 Design Pressure

Design pressure shall be based on existing static pressure and existing residual pressure as determined by tests performed by the Contractor.

1.6.1.3 Controllers

System shall be automatic with controller(s) and remote controlled

valves.

1.6.1.4 Backflow Preventer

A backflow preventer shall be installed on the main between the tie-in to the potable water supply and the first valve off the main.

1.6.1.5 Gate Valve

A gate valve shall be installed upstream of the backflow preventer.

1.6.1.6 Fixed Pipe Risers

Fixed pipe risers above grade shall be copper tubing.

1.6.1.7 Economical and Operational System

The sprinkler system shall be designed utilizing pipe sizes, valves, heads, and zone operation time schedules, to assure an economical and operational system.

1.6.1.8 Mains

Mains shall be manually drainable.

1.6.1.9 Zones

Zones shall be drained automatically.

1.6.2 Head Layout

1.6.2.1 Turfed Areas

1.6.2.1.1 Triangular spacing of heads having the same diameter of coverage shall be used as the basic pattern.

1.6.2.1.2 Spacing between heads having the same diameter of coverage shall be a maximum of 60% of the diameter or the manufacturer's recommended spacing for a 4 mph wind, whichever is less.

1.6.2.1.3 Equal spacing shall be used between heads of the same diameter of coverage on rows and between rows of heads.

1.6.2.1.4 Part-circle heads, compatible with the basic pattern heads, shall be used at borders between turfed areas and buildings, streets, walks, etc. Wasted coverage onto these areas shall be minimized except that spray onto buildings will not be allowed.

1.6.2.1.5 Fill-in heads shall be used in areas where the basic pattern cannot be maintained or where the pattern is obstructed by trees, shrubs, poles, etc. Future size of plants shall be considered in placing fill-in heads in the latter case. Minimum overlap between fill-in heads and basic pattern heads shall be the overlap between basic pattern heads.

1.6.2.1.6 Swing joints shall be used for sprinklers in turf areas.

1.6.2.2 Landscaped Areas

1.6.2.2.1 Spacing of heads shall be as outlined under Turfed Areas. Plants over 24 inches in height shall receive water from at least two sides.

1.6.2.2.2 Spray shall be above landscaped plantings from pop-up riser shrub heads except where plants will exceed 24 inches in height. Future size of plants shall be used for determining height of pop-ups which shall not exceed 24 inches.

1.6.2.2.3 Bubblers shall be provided in landscaped areas where semi-flood watering is required. Throttle valves shall be used to control amount of flooding.

1.6.2.2.4 Quick couplers shall be provided as indicated.

1.6.3 Pipe Sizing

1.6.3.1 Flow velocities shall be less than 9 ft/sec for spray head zones and less than 5 ft/sec for rotary zones.

1.6.3.2 Pressure losses due to meters, valves, backflow preventer, pipe, pipe fittings, elevational differences, etc., shall be used in sizing lines.

1.6.3.3 Pressure available at each head shall be at least the minimum specified by the manufacturer and shall not exceed the maximum specified.

1.6.3.4 Pressure difference between the first and last heads of a spray head zone shall not exceed 30% of the recommended minimum head operating pressure. Differential pressure between the first and last heads of a rotary zone shall not exceed 10 psi.

1.6.4 Zoning

1.6.4.1 Spray and rotary type heads shall not be installed in the same zone. Heads within the same zone shall be compatible.

1.6.4.2 Number of zones established shall minimize system operation time within economic reason as to size of pipe and number of operating valves required.

1.6.4.3 Separate zones shall be provided for landscaped areas where watering requirements are different from the turfed areas.

1.6.5 Electrical

1.6.5.1 Rules

The installation shall conform to the requirements of NFPA 70, unless more stringent requirements are indicated herein.

1.6.5.2 Coordination

The contract drawings indicate the extent and general location of equipment. The Contractor shall become familiar with all details of the

work and verify all dimensions in the field so that the equipment will be properly located and readily accessible. Equipment shall be located to avoid interference with mechanical or structural features. If any conflicts occur necessitating departures from the drawings, details and reasons for departures shall be submitted and approved prior to implementing any change.

1.6.5.3 Workmanship

Materials and equipment shall be installed in accordance with recommendations of the manufacturer.

1.6.5.4 Wiring

Wiring between controllers and valves shall be Type UF cable in accordance with Article 339 of NFPA 70. Wiring shall comply with the manufacturer's recommendations.

1.7 PERFORMANCE

1.7.1 System shall be zoned and timed to provide 1-inch of water per week on the turfed areas indicated. A minimum of three operations shall be designed for each zone per week. Landscaped areas indicated shall receive 1-inch of water per week.

1.7.2 Any zone or part of a zone which does not meet the requirements of the previous paragraph within the schedule of operating times, in the opinion of the Contracting Officer, shall be redesigned and the appropriate number and type of heads added to provide the specified coverage at no additional cost to the Government.

1.8 DELIVERY AND STORAGE

Products delivered to site shall be inspected for damage, unloaded, and stored with the minimum of handling. Products shall be protected from the weather; excessive humidity and temperature variation; direct sunlight (in the case of plastic or rubber materials); and dirt, dust, or other contaminants. Do not store products directly on the ground. Inside of pipes and fittings shall be kept free of dirt and debris.

1.9 HANDLING

Products shall be handled in such a manner as to insure delivery to the trench in sound undamaged condition. Pipe shall be carried to the trench, not dragged. Gasket materials and plastic materials that are not to be installed immediately shall not be stored in the direct sunlight. Valves, controllers, sprinkler heads, etc., shall be removed from protective cover only upon installation.

1.10 FIELD MEASUREMENTS

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer who has produced similar systems which have performed well for a minimum period of 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Nameplates

Each item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.3 Extra Stock

The following extra stock shall be provided: Two sprinkler heads of each size and type, two valve keys for operating manual valves, two wrenches for removing and installing each type of head, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

2.2 PIPING MATERIALS

2.2.1 Polyvinyl Chloride (PVC) Pipe, Fittings and Solvent Cement

2.2.1.1 Pipe

Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40; or ASTM D 2241, PVC 1120 SDR 21, Class 200.

2.2.1.2 Fittings

Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded type fittings shall conform to requirements of ASTM D 2464, Schedule 80.

2.2.1.3 Solvent Cement

Solvent cement shall conform to the requirements of ASTM D 2564.

2.2.2 Polyethylene (PE) Plastic Piping

2.2.2.1 Pipe

Pipe shall conform to AWWA C901, outside diameter base with dimension ratio (DR) of 9.3 to provide 150 psi minimum pressure rating.

2.2.2.2 Fittings

Fittings shall conform to ASTM D 3261, DR of 9.3.

2.2.3 Dielectric Fittings

Fittings shall conform to ASTM F 441, Schedule 80, CPVC threaded pipe nipples, 4-inch minimum length.

2.2.4 Emitter Hose and Distribution Tubing

Emitter hose and distribution tubing shall conform to ASTM D 2287, maximum inside diameter of 1/2-inch, minimum wall thickness of 90 mils, vinyl plastic extruded from non-rigid chloride, integrally algae-resistant, homogeneous throughout, smooth inside and outside, free from foreign materials, cracks, serrations, blisters and other effects. Slip fittings shall be provided.

2.3 SPRINKLER AND EMITTER HEADS

2.3.1 Pop-Up Spray Heads

Pop-up spray heads shall conform to the requirements of FS WW-H-001220, Type II, Class A, B, C, and D. Nozzle rises a minimum of 4 inches above body. Swing joints shall be used for pop-up sprinklers in turf areas.

2.3.1.1 Shrubbery Sprinkler Heads

Sprinkler heads shall be conical spray with adjustable or non-adjustable coverage and designed for permanent aboveground mounting on riser or pop-ups at a height compatible with ground covers. Provide brass nozzles.

2.3.2 Rotary Pop-Up Sprinklers

Sprinklers shall be have adjustable radii and shall have matched gpm requirements. Construction shall be high impact molded plastic with filter screen, reducible watering radius, and choice of nozzles and have adjustable radius capabilities. Swing joints shall be used for sprinklers in turf areas.

2.3.3 Bubbler Sprinkler Heads

Heads shall be multiple-spray bubbler with adjustable flow and designed for permanent aboveground mounting on risers.

2.3.4 Surface Connected Lawn Sprinkler Heads

Heads shall conform to the requirements of FS WW-S-610; Type I, Class A, B, C, and D; Type II; Type III, Class e, f, g; Type IV, Class h, j.

2.3.5 Emitter Heads

Emitter heads shall be self-cleaning, pressure compensating diaphragm with one or six self-piercing barbed outlets; each capable of emitting from 1/4 to 2 gallons per hour flow. Emitter body shall be ultraviolet stabilized, algae, and heat resistant plastic construction.

2.4 VALVES

2.4.1 Gate Valves, Less than 3 Inches

Gate valves shall conform to the requirements of MSS SP-80, Type 1, Class 150, threaded or soldered ends.

2.4.2 Gate Valves, 3 Inches and Larger

Gate valves shall conform to the requirements of AWWA C509 and have encapsulated resilient wedge, parallel seats, non-rising stems, and open by counterclockwise turning. End connections shall be flanged. Interior construction of valves shall be bronze including stem containing a maximum 2 percent aluminum and maximum 16 percent zinc.

2.4.3 Angle Valves, Less Than 2 1/2 Inches

Angle valves shall conform to the requirements of MSS SP-80, Type 3, Class 150 threaded or soldered ends.

2.4.4 Angle Valves, 2 1/2 Inches and Larger

Angle valves shall conform to the requirements of MSS SP-85, Type II, Class 250 threaded or flanged ends.

2.4.5 Quick Coupling Valves

Quick coupling valves shall have brass parts and shall be two-piece unit consisting of a coupler water seal valve assembly and a removable upper body to allow spring and key track to be serviced without shutdown of main. Lids shall be lockable vinyl with spring for positive closure on key removal.

2.4.6 Remote Control Valves, Electrical

Remote control valves shall be solenoid actuated globe valves of 3/4- to 3-inch size, suitable for 24 volts, 60 cycle, and designed to provide for shut-off in event of power failure. Valve shall be cast bronze or brass or plastic housing suitable for service at 150 psi operating pressure with external flow control adjustment for shut-off capability, external plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

2.4.7 Drain Valves

2.4.7.1 Manual Valves

Manual valves shall conform to requirements of MSS SP-80, Type 3, Class 150 threaded or soldered ends for sizes less than 2 1/2 Inches and MSS SP-85, Type II, Class 250 threaded or flanged ends for sizes 2 1/2 inches and larger.

2.4.7.2 Automatic Valves

Automatic valves shall be brass or plastic, spring loaded ball drip type, 150 pounds and threaded ends, designed to close at 6-foot pressure head with positive seal at 3 psi pressure or greater and be open to drain at less than 3 psi pressure.

2.4.8 Pressure Regulating Master Valve

Pressure regulating master valve shall be automatic mechanical self-cleaning, self-purging control system having an adjustable pressure setting operated by a solenoid at 24 volts. Valve shall close slowly and be free of chatter in each diaphragm position, have manual flow stem to adjust closing speed and internal flushing, and one or two inlet tappings capable of being installed as a straight pattern valve. Body shall be cast bronze or brass with removable brass seat serviceable from top without removing valve body from system. Valve shall operate at 150 psi working pressure and pilot range from 10 to 125 psi.

2.4.9 Backflow Preventers

Reduced pressure principle assemblies or double check valve assemblies shall be tested, approved, and listed in accordance with FCCCHR-01. Backflow preventers shall conform to appropriate ASSE. Testing of backflow preventers shall in accordance with Section 15400, PLUMBING, GENERAL PURPOSE, paragraph Test of Backflow Prevention Assemblies.

2.4.9.1 Pressure Type Vacuum Breaker

Vacuum breaker shall conform to the requirements of ASSE 1020 and shall be bronze construction, with one or two check valves, vacuum relief, inlet and discharge shut-offs valves, field test cocks, and vacuum relief opening of greater diameter than unit.

2.4.9.2 Reduced Pressure Type and Double Check Type Backflow Preventers

Backflow preventers shall be 150-pound flanged cast iron, mounted gate valve and strainer, 304 stainless steel or bronze, internal parts. Total pressure drop through complete assembly shall be a maximum of 10 psi at rated flow. Piping adjacent to backflow preventer shall be as indicated. Strainers shall be bronze or brass construction with gasket caps. Units shall have 200-mesh stainless steel screen elements.

2.5 ACCESSORIES AND APPURTENANCES

2.5.1 Valve Keys for Manually Operated Valves

Valve keys shall be 1/2-inch diameter by 3 feet long, tee handles and keyed to fit valves.

2.5.2 Valve Boxes and Concrete Pads

2.5.2.1 Valve Boxes

Valve boxes shall be cast iron, plastic lockable, or precast concrete for each gate valve, manual control valve and remote control valve. Box sizes shall be adjustable for valve used. Word "IRRIGATION" shall be cast on cover. Shaft diameter of box shall be minimum 5-1/4 inches. Cast iron box shall have bituminous coating.

2.5.2.2 Concrete Pads

Concrete pads shall be precast or cast-in-place reinforced concrete construction for reduced pressure type backflow preventers.

2.5.3 Pressure Gauges

Pressure gauges shall conform to requirements of ASME B40.1, single style pressure gauge for water with 4-1/2-inch-dial brass or aluminum case, bronze tube, gauge cock, pressure snubber, and siphon. Scale range shall be suitable for irrigation sprinkler systems.

2.5.4 Service Clamps

Service clamps shall be bronze flat, double strap, with neoprene gasket or "O"-ring seal.

2.5.5 Water Hammer Arresters

Water hammer arrester shall conform to the requirements of ASME A112.26.1M; stainless steel construction with an encased and sealed bellows compression chamber.

2.5.6 Emitter Head Accessories

2.5.6.1 Strainer

Strainer shall be provided at inlet to each drip line. Strainer shall have stainless steel screen having equivalent of 140-mesh filtration capacity and incorporate flush valves within strainer to clean screen without disassembling unit.

2.5.6.2 Pressure Regulator

Pressure regulator shall be provided at each drip system if supply pressure exceeds 50 psi.

2.5.6.3 Riser Adapters

Riser adapters shall be provided with a rigid piping system.

2.5.6.4 Tubing Stakes

Tubing stakes shall be plastic coated steel, or other non-corrosive strong material to secure tubing.

2.5.6.5 Emitter Outlet Check Valve (Bug Cap)

Check valves shall be provided at end of each emitter outlet distribution line. Valves shall permit free flow of water with minimum restriction; prevent back siphoning, entry of insects, and contamination into outlet ports.

2.5.6.6 Access Sleeve

Access sleeve shall be provided at buried emitters placed in covered boxes. Lids of access sleeve shall be secured with removable lugs. Drip hose in both vertical and horizontal axis shall be secured.

2.5.6.7 Closure Caps

Closure caps shall be in accordance with manufacturer's recommendations.

2.6 AUTOMATIC CONTROLLERS, ELECTRICAL

Controller shall conform to the requirements of NEMA ICS 2 with 120-volt single phase service, operating with indicated stations, and grounded chassis. Enclosure shall conform to NEMA ICS 6 Type 3R, with locking hinged cover, wall-mounted. Controller shall be programmed for various schedules by setting switches and dials equipped with the following features: A switch for each day of week for three schedules, allowing each station to be scheduled individually as to days of watering; a minute switch for each station with a positive increment range of 0 to 3 hours, set time within one percent; a switch allowing selected schedules to be repeated after each completion of initial watering schedule and allowing each operation to be scheduled throughout a 24-hour day; a circuit breaker for surge protection; and circuit for a 9-volt rechargeable NiCad battery. Three control panels shall be used: Option 3A- Courtyard; Option 3B- Trees, shrubs and turf along the building perimeter; and 3C- Parade Ground turf. (See Plans).

2.7 ELECTRICAL WORK

Wiring and rigid conduit for electrical power shall be in accordance with NFPA 70, and Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

2.8 CONCRETE MATERIALS

Concrete shall have a compressive strength of 3000 psi at 28 days as specified in Section 03300 CONCRETE FOR BUILDING CONSTRUCTION.

2.9 WATER SUPPLY MAIN MATERIALS

Tapping sleeves, service cut off valves, and connections to water supply mains shall be in accordance with Section 02660 WATER LINES.

2.10 INSULATING JOINTS

Insulating joints and dielectric fittings shall be in accordance with Section 02660 WATER LINES.

PART 3 - EXECUTION

3.1 INSTALLATION

Sprinkler system shall be installed after site grading has been completed. Excavation, trenching, and backfilling for sprinkler system shall be in accordance with the applicable provisions of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

3.1.1 Trenching

Trench around roots shall be hand excavated to pipe grade when roots of 2 inches diameter or greater are encountered. Trench width shall be 4 inches minimum or 1-1/2 times diameter of pipe, whichever is wider. Backfill shall be hand tamped over excavation. When rock is encountered, trench shall be excavated 4 inches deeper and backfilled with silty sand (SM) or well-graded sand (SW) to pipe grade. Trenches shall be kept free of obstructions and debris that would damage pipe. Subsoil shall not be

mixed with topsoil. Existing concrete walks, drives and other obstacles shall be bored at a depth conforming to bottom of adjacent trenches. Pipe sleeves for bored pipe shall be two pipe diameters larger than sprinkler pipe.

3.1.2 Piping System

3.1.2.1 Cover

Underground piping shall be installed as to meet the minimum depth of backfill cover specified.

3.1.2.2 Clearances

Minimum horizontal clearances between lines shall be 4 inches for pipe 2 inches and less; 12 inches for 2-1/2 inches and larger. Minimum vertical clearances between lines shall be 1-inch.

3.1.2.3 Minimum Slope

Minimum slope shall be 6 inches per 100 feet in direction of drain valves.

3.1.3 Piping Installation

3.1.3.1 Polyvinyl Chloride (PVC) Pipe

a. Solvent-cemented joints shall conform to the requirements of ASTM D 2855.

b. Threaded joints shall be full cut with a maximum of three threads remaining exposed on pipe and nipples. Threaded joints shall be made tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.

c. Piping shall be joined to conform with requirements of ASTM D 2774 or ASTM D 2855, and pipe manufacturer's instructions. Pipe shall be installed in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Pipes shall be installed at temperatures over 40 degrees F.

3.1.3.2 Soldered Copper Tubing

Pipe shall be reamed and burrs removed. Contact surfaces of joint shall be cleaned and polished. Flux shall be applied to male and female ends. End of tube shall be inserted into fittings full depth of socket. After soldering, a solder bead shall show continuously around entire joint circumference. Excess acid flux shall be removed from tubings and fittings.

3.1.3.3 Threaded Brass or Galvanized Steel Pipe

Prior to installation, pipe shall be reamed. Threads shall be cut in conformance with ASME B1.2. Pipe joint compound shall be applied to male end only.

3.1.3.4 Insulating Joints

Insulating and dielectric fittings shall be provided where pipes of dissimilar metal are joined and at connections to water supply mains as shown. Installation shall be in accordance with Section 02660 WATER LINES.

3.1.4 Valves

3.1.4.1 Manual Valves

Valves shall be installed in a valve box extending from grade to below valve body, with a minimum of 4 inches cover measured from finish grade to top of valve stem.

3.1.4.2 Automatic Valves

Valve shall be set plumb in a valve box extending from grade to below valve body, with minimum of 4-inch cover measured from grade to top of valve. Install automatic valves beside sprinkler heads with a valve box.

3.1.4.3 Drain Valves

Entire system shall be manually or automatically drainable. Low points of system shall be equipped with drain valve draining into an excavation containing 1 cubic foot gravel. Gravel shall be covered with building paper then backfilled with excavated material and 6 inches of topsoil.

3.1.5 Sprinklers and Quick Coupling Valves

Sprinklers and valves shall be installed plumb and level with terrain.

3.1.6 Installation of Drip Irrigation System

3.1.6.1 Emitter Hose

Emitter laterals shall be buried 6 inches deep. Connections shall be solvent welded in accordance with manufacturer's recommendation to standard weight Schedule 40 PVC fittings and bushings. Hose shall be installed in a serpentine manner. When cutting hose, shearing tool such as a pipe cutter, knife, or shears shall be used. Manufacturer's recommended tool and procedures when punching hose for emitters shall be followed.

3.1.6.2 Emitter Heads

Emitters shall be installed in a plastic emitter box. Emitter on a rigid PVC nipple shall be connected to PVC drip lateral with a tee or elbow. Tubing shall be attached to barbed fitting and daylight distribution tubing at root ball secured with stake, with bug cap at end of secured distribution tubing. After installing emitters and before operating system, end of drip lateral shall be opened and flushed clean. The number of emitters on a line shall not exceed manufacturer's recommendations for that hose or distribution tubing size and length.

3.1.6.3 Tubing Stakes

Main irrigation line shall be secured with stakes where line is

aboveground. Stakes shall be spaced to ensure that hose does not shift location in presence of foot traffic, operations, gravity on slope installations, or environmental effects. Discharge of the emitter distribution tubing shall be staked to ensure that discharge point of emitter will be maintained at specified position in relation to plant material to be irrigated.

3.1.7 Backflow Preventers

Backflow preventer shall be installed in new connection to existing water distribution system, between connection and control valves. Backflow preventer shall be installed with concrete pads.

3.1.7.1 Reduced Pressure Type

Reduced pressure type shall be installed as follows: Flush pipe lines prior to installing device and protect device by a strainer located upstream. Device shall not be installed in pits or where any part of device could become submerged in standing water.

3.1.8 Control Wire and Conduit

3.1.8.1 Wires

Low voltage wires may be buried beside pipe in same trench. Rigid conduit shall be provided where wires run under paving. Wires shall be number tagged at key locations along main to facilitate service. One control circuit shall be provided for each zone and a circuit to control sprinkler system.

3.1.8.2 Loops

A 12-inch loop of wire shall be provided at each valve where controls are connected.

3.1.8.3 Expansion and Contraction

Multiple tubes or wires shall be bundled and taped together at 20-foot intervals with 12-inch loop for expansion and contraction.

3.1.8.4 Splices

Electrical splices shall be waterproof.

3.1.9 Automatic Controller

Exact field location of controllers shall be determined before installation. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

3.1.10 Thrust Blocks

Concrete shall be placed so that sides subject to thrust or load are against undisturbed earth, and valves and fittings are serviceable after concrete has set. Thrust blocks shall be as specified in section 02660 WATER LINES.

3.1.11 Backfill

3.1.11.1 Minimum Cover

Depth of cover shall be 18 inches for 1-1/4-inch pipe or smaller; 24 inches for 1-1/2- to 2-inch pipe; 24 inches for 2 1/2-inch pipe or larger; 36 inches for pipes under traffic loads, farm operations, and freezing temperatures; and 12 inches for low-voltage wires. Remainder of trench or pipe cover shall be filled to within 3 inches of top with suitable soil, and compact soil with plate hand-held compactors to same density as undisturbed adjacent soil.

3.1.11.2 Restoration

Top 3 inches shall be filled with topsoil and compacted with same density as surrounding soil. Lawns and plants shall be restored in accordance with Section 02933 ESTABLISHMENT OF TURF, and Section 02961 TREES, SHRUBS, GROUND COVERS AND VINES. Pavements shall be restored to original condition.

3.1.12 Adjustment

After grading, turfing, and rolling of planted areas, sprinkler heads shall be adjusted flush with finished grade. Adjustments shall be made by providing new nipples of proper length or by use of heads having an approved device, integral with head, which will permit adjustment in height of head without changing piping.

3.1.13 Disinfection

Sprinkler system fed from a potable water system shall be disinfected upstream of backflow preventer in accordance with Section 02660 WATER LINES.

3.1.14 Cleaning of Piping

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by Contracting Officer.

3.2 FIELD TESTS

All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor.

3.2.1 Hydrostatic Pressure Test

Piping shall be tested hydrostatically before backfiling and proved tight at a hydrostatic pressure of 150 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi. If hydrostatic pressure cannot be held for a minimum of 4 hours, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer.

3.2.2 Leakage Tests

Leakage tests for service main shall be in accordance with Section 02660 WATER LINES.

3.2.3 Operation Test

At conclusion of pressure test, sprinkler heads or emitter heads, quick coupling assemblies, and hose valves shall be installed and entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be sprinkled.

3.3 POSTING FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system. After as-built drawings are approved by Contracting Officer, controller charts and programming schedule shall be prepared. One chart for each controller shall be supplied. Chart shall be a reduced drawing of actual as-built system that will fit the maximum dimensions inside controller housing. Black line print for chart and a different pastel or transparent color shall indicate each station area of coverage. After chart is completed and approved for final acceptance, chart shall be sealed between two 20-mil pieces of clear plastic.

3.4 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of four hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals. Training class shall be videotaped by Contractor on VCR tape and tape provided to the Government.

3.5 CLEANUP

Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 02831A - FENCE, CHAIN-LINK

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 94-\	(1992a) Ready-Mixed Concrete

FEDERAL SPECIFICATIONS (FS)

\-FS RR-F-191/GEN-\	(Rev K) Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and Accessories)
\-FS RR-F-191/1-\	(Rev D) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric)
\-FS RR-F-191/2-\	(Rev D) Fencing, Wire and Post, Metal (Chain-Link Fence Gates)
\-FS RR-F-191/3-\	(Rev D) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
\-FS RR-F-191/4-\	(Rev D) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)

1.2 EXISTING FENCE

Removal of refuse and disposal of existing fencing shall be as indicated and as specified in Section \=02050=\ DEMOLITION.

PART 2 - PRODUCTS

2.1 CHAIN LINK FENCE

\-FS RR-F-191/GEN-\. When connecting to existing fence, the type or class of fabric, gates, posts, and accessories shall be equivalent in materials and quality to existing fence. Type and class shall be uniform.

2.1.1 Fabric

\-FS RR-F-191/1-\, Type I, with minimum coating of 1.2 ounces of zinc per square foot of coated surface. Fabric shall be fabricated of 9-gauge wire woven in 2-inch mesh. Fabric height shall be 7 feet.

2.1.2 Gates

\-FS RR-F-191/2-\. Gate shall be the type and swing shown. Gate frames shall be constructed of Class 1 Grade A or B, steel pipe, size SP2 as specified in \-FS RR-F-191/3-\. Each end member of gate frames shall be extended sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence. Gate leaves more than \8 feet\ wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8 feet wide shall have truss rods or intermediate braces. Gate fabric shall be attached by method standard with the manufacturer. Hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged so that padlock will be accessible from both sides of the gate.

2.1.3 Posts

\-FS RR-F-191/3-\, zinc-coated; Class 1 Grade A or B, steel pipe; Class 3, formed steel sections; or Class 6, steel square sections. Class 4, steel H-sections may be used for line posts in lieu of line post shapes specified for other classes. Sizes shall be as specified in \-FS RR-F-191/3-\.

2.1.4 Braces and Rails

\-FS RR-F-191/3-\, zinc-coated Class 1 Grade A or B, steel pipe, size SP1. Class 3, formed steel sections, size FS1, may be used if Class 3 line posts are furnished.

2.1.5 Accessories

\-FS RR-F-191/4-\. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment.

2.2 CONCRETE

\-ASTM C 94-\, mixture designed for a minimum compressive strength of 2000 psi at 28 days.

PART 3 - EXECUTION

3.1 GENERAL

Fence shall be installed to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line post shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet.

3.2 POSTS

Posts shall be set plumb and in alignment. Posts shall be set in concrete to the depth indicated unless solid rock is encountered. Where solid rock is encountered, posts shall be set to the lesser of 18 inches in solid rock or indicated depth. All portions of posts set in rock shall be

grouted. Portions of posts not set in rock shall be set in concrete from the rock to ground level. Posts set in concrete shall be set in holes not less than indicated diameter. Diameters of holes in solid rock shall be at least 1 inch greater than the largest cross section of the post. Concrete and grout shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure for 72 hours prior to attachment of any item to the posts. Class 3 line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Driven posts shall be set a minimum of 3 feet and shall be protected with drive caps when being set.

3.3 Not used.

3.4 BRACES AND TRUSS RODS

Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished.

3.5 TENSION WIRES

Tension wires shall be installed along the top and bottom of the fence line and attached to the terminal posts of each stretch of the fence. Top tension wires shall be installed within the top 1 foot of the installed fabric. Bottom tension wire shall be installed within the bottom 6 inches of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

3.6 CHAIN-LINK FABRIC

Chain-link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15-inch intervals. Fabric shall be pulled taut to provide a smooth, uniform appearance free from sag. Fabric shall be fastened to line posts at approximately 15-inch intervals and fastened to rails and tension wires at approximately 24-inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined.

3.7 GATES

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Slide gates shall be installed as recommended by the manufacturer. Padlocks shall be attached to gates or gate posts with chains to prevent padlock removal.

3.8 GROUNDING

Fences crossed by powerlines of 600 volts or more shall be grounded as specified in Section \=16670=\ LIGHTNING PROTECTION SYSTEM.

- - o 0 o - -

-- End of Section --

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.2	(1991) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 213R	(1987) Guide for Structural Lightweight Aggregate Concrete
ACI 214.3R	(1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results
ACI 301	(1996) Standard Specifications for Structural Concrete
ACI 303R	(1991) Guide to Cast-In-Place Architectural Concrete Practice
ACI 305R	(1991) Hot Weather Concreting
ACI 318/318R	(1995) Building Code Requirements for Reinforced Concrete and Commentary

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(1991) Burlap Cloth Made From Jute or Kenaf

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31	(1991) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1993) Concrete Aggregates

ASTM C 39	(1994) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42	(1994) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 94	(1996) Ready-Mixed Concrete
ASTM C 131	(1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1995a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 150	(1995) Portland Cement
ASTM C 171	(1995) Sheet Materials for Curing Concrete
ASTM C 172	(1990) Sampling Freshly Mixed Concrete
ASTM C 173	(1994a) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192	(1990a) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1995) Air-Entraining Admixtures for Concrete
ASTM C 309	(1995) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 330	(1989) Lightweight Aggregates for Structural Concrete
ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 496	(1990) Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 567	(1991) Unit Weight of Structural Lightweight Concrete
ASTM C 618	(1996a) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C 685	(1995) Concrete Made by Volumetric Batching and Continuous Mixing

ASTM C 881	(1990) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 937	(1980; R 1991) Grout Fluidifier for Preplaced-Aggregate Concrete
ASTM C 940	(1989) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C 1017	(1992) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1059	(1991) Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C 1064	(1986; R 1993) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1995a) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1107	(1991a)Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 1155	(1996) Determining Floor Flatness and Levelness Using the F-Number System

CORPS OF ENGINEERS (COE)

COE CRD-C 94	(1995) Surface Retarders
COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints

	in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(1995) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA TMMB-01	(1992) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards of the Truck Mixer Manufacturers Bureau
NRMCA CPMB 100	(1990) Concrete Plant Standards
NRMCA QC 3	(1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

1.2 LUMP SUM CONTRACT

Under this type of contract concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

1.3 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-08 Statements\

Mixture Proportions\; *GA*\.

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

Lightweight Aggregate Concrete\; *FIO*\.

Written recommendations from lightweight aggregate supplier on batching and mixing cycles.

Dry Shake Finish\; *FIO*\.

Manufacturer's written instructions on application of dry shake material 15 days prior to start of construction.

SD-09 Reports\

Testing and Inspection for Contractor Quality Control\; *GA*\.

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

SD-13 Certificates\

Qualifications\; *FIO*\.

Written documentation for Contractor Quality Control personnel.

SD-14 Samples\

Surface Retarder\; *FIO*\.

Surface retarder material with manufacturer's instructions for application in conjunction with air-water cutting.

1.4 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I
Concrete Laboratory Testing Technician, Grade I or II
Concrete Construction Inspector, Level II

All personnel performing sampling and testing of concrete will be ACI certified as a Level I field testing technician. ACI personnel will remain on site during entire concrete placement.

1.5 GENERAL REQUIREMENTS

1.5.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible

after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.5.1.1 Floors

For the purpose of this Section the following terminology correlation between ACI 117/117R and this Section shall apply:

Floor Profile Quality Classification From ACI 117/117R	This Section
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish
Very Flat	Same. Use only with F-system

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

1.5.1.2 Floors by the F-Number System

The flatness and levelness of floors shall be carefully controlled and the tolerances shall be measured by the F-Number system of Paragraph 4.5.6 and 4.5.6.1 of ACI 117/117R. The Contractor shall furnish an approved floor profilograph or other equipment capable of measuring the floor flatness (FF) number and the floor levelness (FL) number in accordance with ASTM E 1155. The Contractor shall perform the tolerance measurements within 72 hours after floor slab construction while being observed by the Contracting Officer. The tolerances of surfaces beyond the limits of ASTM E 1155 (the areas within 24 inches of embedments and construction joints) shall be acceptable to the Contracting Officer. Tolerances of the following areas shall meet the requirements for the listed surfaces as specified in paragraphs 4.5.6 and 4.5.6.1 of ACI 117/117R.

Bullfloated-	All Areas
Straightedged-	All Areas
Float Finish-	All Areas
Trowel Finish-	All Areas
Very Flat-	All Areas

1.5.1.3 Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117/117R, using a 10 foot straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straightedge can be placed.

Bullfloated	1/2″
Straightedged	5/16"
Float Finish	3/16"
Trowel Finish	1/8"

1.5.2 Strength Requirements and w/c Ratio

1.5.2.1 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
3000 psi at 28 days (650 psi flexural strength)	All Areas

Concrete slabs on-grade shall have a 28-day flexural strength of 650 psi. Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement. Compressive strength shall be determined in accordance with ASTM C 39. Flexural strength shall be determined in accordance with ASTM C 78.

a. Evaluation of Concrete Compressive Strength. Compressive strength specimens 6 by 12 inch cylinders shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

(1) Testing. Samples for strength tests of each class of concrete shall be taken not less than once a day, not less than once for each 100 cubic yards, nor less than once per each 5000 square feet of surface area for slabs or walk; whichever, is greater. Field cured specimens for determining form removal time or when a structure may be put in service shall be made in numbers directed to check the adequacy of curing and protection of concrete in the structure. The specimens shall be removed from the molds at the age of 24 hours and shall be cured and protected, insofar as possible, in the same manner as that given to the portion of the structure the samples represent.

b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 500 psi or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for

acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.

c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

d. Evaluation of Concrete Flexural Strength. Flexural strength specimens (beams) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31 and tested in accordance with ASTM C 78. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified flexural strength and no individual test result falls below the specified flexural strength by more than 50 psi. A "test" is defined as the average of two companion beams. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the slab is considered potentially deficient.

1.5.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

WATER-CEMENT RATIO, BY WEIGHT	STRUCTURE OR PORTION OF STRUCTURE
0.50 to 0.55	All of structure

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

1.5.3 Air Entrainment

Except as otherwise specified for lightweight concrete, all normal weight concrete shall be air entrained to contain between 3 to 5 percent total air, except that when the nominal maximum size coarse aggregate is 3/4 inch or smaller it shall be between 4.5 and 7.5 percent. Lightweight concrete in the **second floor** of the structure shall be air-entrained with a total air content of 4 to 8 percent, except that if the nominal maximum size coarse aggregate is 3/8 inch or less, the air content shall be 5.5 to 8.5

percent. Air content for lightweight concrete shall be determined in accordance with ASTM C 173.

1.5.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143.

Structural Element	Slump Minimum	Slump Maximum
Walls, columns and beams	2 in.	4 in.
Foundation walls, substructure walls, footings, slabs	1 in.	3 in.
Any structural concrete approved for placement by pumping:	4 in.	6 in.

If plasticizers are used, they will be added at project site. When use of a plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 inches before the admixture is added and a maximum slump of 8 inches at the point of delivery after the admixture is added. For troweled floors, slump of structural lightweight concrete with normal weight sand placed by pump shall not exceed 5 inches at the point of placement. For other slabs, slump of lightweight concrete shall not exceed 4 inches at point of placement.

1.5.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 90 degrees F. When the ambient temperature during placing is 40 degrees F or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 55 and 75 degrees F.

1.5.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.5.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

1.5.8 Lightweight Aggregate Structural Concrete
[amend 1]

Lightweight aggregate structural concrete shall conform to the requirements specified for normal weight concrete except as specified herein. Specified compressive strength shall be at least **3,000 psi** at 28 days,as determined by test specimens that have been air dried at 50 percent relative humidity for the last 21 days. Air-dry unit weight shall be not over **120 pcf** at 28 days as determined by ASTM C 567. However, fresh unit weight shall be used for acceptance during concreting, using a correlation factor between the two types of unit weight as determined during mixture design studies. Fresh unit weights of lightweight concrete will be plus or minus 2 lbs of concrete designs for acceptance prior to placement. Lightweight aggregate structural concrete floor fill shall have a 28-day compressive strength of at least 3000 psi and an air-dry unit weight not exceeding 115 pcf.

1.5.9 Technical Service for Specialized Concrete

The services of a factory trained technical representative shall be obtained to oversee proportioning, batching, mixing, placing, consolidating, and finishing of specialized structural concrete, such as **the use of admixtures in concrete**. The technical representative shall be on the job full time until the Contracting Officer is satisfied that field controls indicate concrete of specified quality is furnished and that the Contractor's crews are capable of continued satisfactory work. The technical representative shall be available for consultation with, and advice to, Government forces.

1.6 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.6.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192 and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in the paragraph Maximum Allowable w/c Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations in ACI 211.1 for the term P, which is used to denote the

weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until provn by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.6.2 Proportioning Studies for Flexural Strength Concrete

Trial design batches, mixture proportioning studies, and testing requirements shall conform to the requirements specified in paragraph Proportioning Studies for Normal Weight Concrete, except that proportions shall be based on flexural strength as determined by test specimens (beams) fabricated in accordance with ASTM C 192 and tested in accordance with ASTM C 78. Procedures given in ACI 211.1 shall be modified as necessary to accommodate flexural strength.

1.6.3 Proportioning Studies for Lightweight Aggregate Structural Concrete

Trial design batches, mixture proportioning studies, and testing requirements shall conform to the requirements specified in paragraph Proportioning Studies for Normal Weight Concrete, except as follows. Trial mixtures having proportions, consistencies and air content suitable for the work shall be made based on methodology described in ACI 211.2, using at least three different cement contents. Trial mixes shall be proportioned to produce air dry unit weight and concrete strengths specified in paragraph GENERAL REQUIREMENTS. Trial mixtures shall be proportioned for maximum permitted slump and air content. Test specimens and testing shall be as specified for normal weight concrete except that 28-day compressive strength shall be determined from test cylinders that have been air dried at 50 percent relative humidity for the last 21 days. Air dry unit weight shall be determined in accordance with ASTM C 567 and shall be designed to be at least 2.0 pcf less than the maximum specified air dry unit weight in paragraph GENERAL REQUIREMENTS. Curves shall be plotted using these results showing the relationship between cement factor and strength and air dry unit weight. Normal weight fine aggregate may be substituted for part or all of the lightweight fine aggregate, provided the concrete meets the strength and unit weight. A correlation shall also be developed showing the ratio between air dry unit weight and fresh concrete unit weight for each mix.

1.6.4 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'cr) exceeding the specified compressive strength (f'c) by the amount indicated below. This required average compressive strength, f'cr, will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'cr during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'cr, the mixture shall be adjusted, as approved, to bring the daily average back up to f'cr. During production, the required f'cr shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

1.6.4.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'c) within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'cr used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

f'cr = f'c + 1.34S where units are in psi

f'cr = f'c + 2.33S - 500 where units are in psi

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

1.6.4.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'cr shall be determined as follows:

If the specified compressive strength f'c is 3,000 to 5,000 psi,

$f'cr = f'c + 1,200$ psi.

1.6.5 Average Flexural Strength Required for Mixtures

The mixture proportions selected during mixture design studies for flexural strength mixtures and the mixture used during concrete production shall be designed and adjusted during concrete production as approved, except that the overdesign for average flexural strength shall simply be 15 percent greater than the specified flexural strength at all times.

1.7 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.8 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

1.8.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.8.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

1.8.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

1.8.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, portland-pozzolan cement, or portland cement in combination with pozzolanand shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

2.1.1 Portland Cement

ASTM C 150, Type I low alkali with a maximum 15 percent amount of tricalcium aluminate, or Type II low alkali or Type V. White portland cement shall meet the above requirements except that it may be Type I, Type II or Type III low alkali. White Type III shall be used only in specific areas of the structure, when approved in writing. The alkali content shall not exceed 0.6 percent.

2.1.2 High-Early-Strength Portland Cement

ASTM C 150, Type III with tricalcium aluminate limited to **[5] [8]** percent, [low alkali]. Type III cement shall be used only in isolated instances and only when approved in writing.

2.1.3 Blended Cements

ASTM C 595, Type IPIS.

2.1.4 Pozzolan (Fly Ash)

ASTM C 618, Class F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. Requirement for maximum alkalies from Table 1A of ASTM C 618 shall apply. If pozzolan is used, it shall never be less than 15 percent nor more than 35 percent by weight of the total cementitious material.

2.2 AGGREGATES

Gradations on fine and coarse aggregates shall be peerformed twice a week during concreting operations. Aggregates shall conform to the following.

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, size designation **1 1/2"**.

2.2.3 Lightweight Aggregate

Lightweight fine and coarse aggregate shall conform to the quality and gradation requirements of ASTM C 330, size **5/8"** for coarse aggregate. Lightweight aggregate shall be prewetted in accordance with the Manufacturer's instructions unless otherwise specified. For pumped concrete, prewetting shall be sufficient to ensure that slump loss through the pump line does not exceed 4 inches.

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.2 Accelerating Admixture

ASTM C 494, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

2.3.4 High-Range Water Reducer

ASTM C 494, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.3.5 Surface Retarder

COE CRD-C 94.

2.3.6 Expanding Admixture

Aluminum powder type expanding admixture conforming to ASTM C 937.

2.4 CURING MATERIALS

2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.

2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

2.6 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C 1107, Grade A, and shall be a commercial formulation suitable for the proposed application.

2.7 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

2.8 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

2.9 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Hangers for suspended ceilings shall be as specified in Section \=09510=\ ACOUSTICAL CEILINGS. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel.

2.10 FLOOR HARDENER

Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These

silicofluorides can be used individually or in combination. Proprietary hardeners may be used if approved in writing by the Contracting Officer.

2.11 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 6 mils or other equivalent material having a vapor permeance rating not exceeding 0.5 perms as determined in accordance with ASTM E 96.

2.12 JOINT MATERIALS

2.12.1 Joint Fillers, Sealers, and Waterstops

Expansion joint fillers shall be preformed materials conforming to ASTM D 1751 or ASTM D 1752. Materials for waterstops shall be in accordance with Section \=03250=\ EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS. Materials for and sealing of joints shall conform to the requirements of Section \=07920=\ JOINT SEALING, \=02592=\ FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS, or COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS.

2.12.2 Contraction Joints in Slabs

Sawable type contraction joint inserts shall conform to COE CRD-C 540. Nonsawable joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of COE CRD-C 540, with the exception of Section 3.4 "Resistance to Sawing". Plastic inserts shall be polyvinyl chloride conforming to the materials requirements of COE CRD-C 572.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section \=03100=\ STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section \=03200=\ CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.1.2 Preparation of Rock

Rock surfaces upon which concrete is to be placed shall be free from oil, standing or running water, ice, mud, drummy rock, coating, debris, and loose, semidetached or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as specified below for Previously Placed Concrete. Rock surfaces shall be kept continuously moist for at least 24 hours immediately prior to placing concrete thereon. All horizontal and approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar proportioned similar to that in the concrete mixture. Concrete shall be placed before the mortar stiffens.

3.1.1.3 Excavated Surfaces in Lieu of Forms

Concrete for footings and walls may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section \=02221=\ EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

3.1.2 Previously Placed Concrete

Concrete surfaces to which additional concrete is to be bonded shall be prepared for receiving the next horizontal lift by cleaning the construction joint surface with either air-water cutting, sandblasting, high-pressure water jet, or other approved method. Concrete at the side of vertical construction joints shall be prepared as approved by the Contracting Officer. Air-water cutting shall not be used on formed surfaces or surfaces congested with reinforcing steel. Regardless of the method used, the resulting surfaces shall be free from all laitance and inferior concrete so that clean surfaces of well bonded coarse aggregate are exposed and make up at least 10-percent of the surface area, distributed uniformly throughout the surface. The edges of the coarse aggregate shall not be undercut. The surface of horizontal construction joints shall be kept continuously wet for the first 12 hours during the 24-hour period prior to placing fresh concrete. The surface shall be washed completely clean as the last operation prior to placing the next lift. For heavy duty floors and two-course floors a thin coat of neat cement grout of about the consistency of thick cream shall be thoroughly scrubbed into the existing surface immediately ahead of the topping placing. The grout shall be a 1:1 mixture of portland cement and sand

passing the No. 8 sieve. The topping concrete shall be deposited before the grout coat has had time to stiffen.

3.1.2.1 Air-Water Cutting

Air-water cutting of a fresh concrete surface shall be performed at the proper time and only on horizontal construction joints. The air pressure used in the jet shall be 100 psi plus or minus, 10 psi, and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. When approved by the Contracting Officer, a surface retarder complying with the requirements of COE CRD-C 94 may be applied to the surface of the lift in order to prolong the period of time during which air-water cutting is effective. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, high-pressure waterjet or sandblasting shall be used as the last operation before placing the next lift.

3.1.2.2 High-Pressure Water Jet

A stream of water under a pressure of not less than 3,000 psi shall be used for cutting and cleaning. Its use shall be delayed until the concrete is sufficiently hard so that only the surface skin or mortar is removed and there is no undercutting of coarse-aggregate particles. If the waterjet is incapable of a satisfactory cleaning, the surface shall be cleaned by sandblasting.

3.1.2.3 Wet Sandblasting

Wet sandblasting shall be used after the concrete has reached sufficient strength to prevent undercutting of the coarse aggregate particles. After wet sandblasting, the surface of the concrete shall then be washed thoroughly to remove all loose materials.

3.1.2.4 Waste Disposal

The method used in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor, or affect exposed surfaces of the structures, or damage the environment of the project area. The method of disposal shall be subject to approval.

3.1.2.5 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be thoroughly washed and shall be moist but without free water when concrete is placed.

3.1.3 Vapor Barrier

Vapor barrier shall be provided beneath the interior on-grade concrete floor slabs. The greatest widths and lengths practicable shall be used to eliminate joints wherever possible. Joints shall be lapped a minimum of 12

inches. Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete. For minor repairs, patches may be made using laps of at least 12 inches. Lapped joints shall be sealed and edges patched with pressure-sensitive adhesive or tape not less than 2 inches wide and compatible with the membrane. Vapor barrier shall be placed directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier. In this case, the surface shall be choked with a light layer of sand, as approved, before placing the vapor barrier. A 2 inch layer of compacted, clean concrete sand (fine aggregate) shall be placed on top of the vapor barrier before placing concrete. Concrete placement shall be controlled so as to prevent damage to the vapor barrier, or any covering sand.

3.1.4 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 1 feet of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

3.2 CONCRETE PRODUCTION

3.2.1 Batching, Mixing, and Transporting Concrete

Concrete shall either be batched and mixed onsite or shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB-01. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall conform to the following subparagraphs.

3.2.1.1 General

The batching plant shall be located off site close to the project. The batching, mixing and placing system shall have a capacity of at least **65** cubic yards per hour. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

3.2.1.2 Batching Equipment

The batching controls shall be semiautomatic or automatic, as defined in NRMCA CPMB 100. A semiautomatic batching system shall be provided with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. The batching system shall be equipped with accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. The weight of water and admixtures shall

be recorded if batched by weight. Separate bins or compartments shall be provided for each size group of aggregate and type of cementitious material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. If both portland cement and other cementitious material are used, they may be batched cumulatively, provided that the portland cement is batched first,. Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Admixtures shall be furnished as a liquid of suitable concentration for easy control of dispensing. An adjustable, accurate, mechanical device for measuring and dispensing each admixture shall be provided. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified miing period. When use of truck mixers makes this requirement impractical, the admixture dispensers shall be interlocked with the sand batchers. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation. The plant shall be arranged so as to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

3.2.1.3 Scales

The weighing equipment shall conform to the applicable requirements of CPMB Concrete Plant Standard, and of NIST HB 44 , except that the accuracy shall be plus or minus 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices. The tests shall be made at the specified frequency in the presence of a Government inspector. The weighing equipment shall be arranged so that the plant operator can conveniently observe all dials or indicators.

3.2.1.4 Batching Tolerances

(A) Tolerances with Weighing Equipment

MATERIAL	PERCENT OF REQUIRED WEIGHT
Cementitious materials	0 to plus 2
Aggregate	plus or minus 2

Water	plus or minus 1
Chemical admixture	0 to plus 6

(B) Tolerances with Volumetric Equipment

For volumetric batching equipment used for water and admixtures, the following tolerances shall apply to the required volume of material being batched:

MATERIAL	PERCENT OF REQUIRED MATERIAL
Water:	plus or minus 1 percent
Chemical admixtures:	0 to plus 6 percent

3.2.1.5 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched.

3.2.1.6 Concrete Mixers

Mixers shall be stationary mixers or truck mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

3.2.1.7 Stationary Mixers

Concrete plant mixers shall be drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or shall be pug mill type and shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixing time and uniformity shall conform to all the requirements in ASTM C 94 applicable to central-mixed concrete.

3.2.1.8 Truck Mixers

Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C 94 . A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Each truck shall be equipped with two counters from which it is possible to determine the number of revolutions at mixing speed and the number of revolutions at agitating speed. Water shall not be added at the placing site unless specifically approved; and in no case shall it exceed the specified w/c. Any such water shall be injected at the base of the mixer, not at the discharge end.

3.3 LIGHTWEIGHT AGGREGATE CONCRETE

In addition to the requirements specified for normal weight concrete, lightweight aggregate concrete shall conform to the following. The batching and mixing cycle shall be as directed based on written recommendations from the aggregate supplier which the Contractor shall furnish. Unless otherwise directed, the mixer shall be charged with approximately 2/3 of the total mixing water and all of the aggregate. This shall be mixed for at least 1-1/2 minutes in a stationary mixer or 15 revolutions at mixing speed in a truck mixer. The remaining ingredients shall then be added and mixing continued as specified for normal weight concrete. Lightweight aggregate concrete shall not be vibrated to the extent that large particles of aggregate float to the surface. During finishing, lightweight aggregate concrete shall not be worked to the extent that mortar is driven down and lightweight coarse aggregate appears at the surface. Lightweight aggregate concrete to be pumped shall have a cement content of at least 564 lb. per cu. yd. A field trial run of lightweight aggregate concrete placement and finishing shall be made in accordance with ACI 213R.

3.4 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers, agitators or by approved pumping equipment conveyors. Nonagitating equipment, other than pumps, shall not be used for transporting lightweight aggregate concrete.

3.5 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

3.5.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 2 square feet. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 2 cubic yards shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

3.5.2 Transfer Hoppers

Concrete may be charged into nonagitating hoppers for transfer to other conveying devices. Transfer hoppers shall be capable of receiving concrete directly from delivery vehicles and shall have conical-shaped discharge features. The transfer hopper shall be equipped with a hydraulically operated gate and with a means of external vibration to effect complete discharge. Concrete shall not be held in nonagitating transfer hoppers more than 30 minutes.

3.5.3 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94. Nonagitating equipment shall be used only for transporting plant-mixed concrete over a smooth road and when the hauling time is less than 15 minutes. Bodies of nonagitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

3.5.4 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3.5.5 Belt Conveyors

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means, such as discharge baffle or hopper , for preventing segregation of the concrete at the transfer points and the point of placing. Belt conveyors shall be constructed such that the idler spacing shall not exceed 36 inches. The belt speed shall be a minimum of 300 feet per minute and a maximum of 750 feet per minute. If concrete is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend through the reinforcing bars.

3.5.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 4 inches. Aluminum pipe shall not be used.

3.6 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient

placing capacity shall be provided so that concrete can be kept free of cold joints.

3.6.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

3.6.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 4 inches thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.025 inch, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segration or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

3.6.3 Cold Weather Requirements

Special protection measures, approved by the Contracting Officer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete

is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

3.6.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 85 degrees F, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	90 F
40-60	85 F
Less than 40	80 F

3.6.4.1 Additional Hot Weather Requirements

Concrete shall be placed in accordance with ACI 305R. During periods of warm weather, the following precautions shall be taken to prevent the formation of plastic-shrinkage cracks resulting from excessive loss of moisture from the concrete:

a. The metal forms and/or underlying base or subgrade materials that will not be covered by vapor barrier or similar material shall be cooled by sprinkling or fogging with water immediately before the placement of concrete.

b. All concrete shall be delivered to the forms at a temperature below 85 degrees F., except that concrete with retarding admixtures may have temperatures of 85° to 90° F as deposited in the forms.

c. Placement may be allowed only at night or in early morning hours if necessary to maintain the concrete temperature and keep forms cool.

d. The concrete shall be placed and finished as rapidly as practicable and curing will start immediately after final finishing has been completed on any section of a floor or placement.

e. The finished surface of the concrete shall be kept damp by applying a water fog or mist with approved spraying equipment until mats can be applied as required by the moist curing method.

f. Curing for the first 24 hours after placement shall be by the moist curing method. After this initial curing period any of the specified methods may be used for the remaining period of curing.

3.6.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.6.6 Placing Concrete in Congested Areas

Special care shall be used to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, waterstops and other tight spacing. An appropriate concrete mixture shall be used, and the nominal maximum size of aggregate (NMSA) shall meet the specified criteria when evaluated for the congested area. Vibrators with heads of a size appropriate for the clearances available shall be used, and the consolidation operation shall be closely supervised to ensure complete and thorough consolidation at all points. Where necessary, splices of reinforcing bars shall be alternated to reduce congestion. Where two mats of closely spaced reinforcing are required, the bars in each mat shall be placed in matching alignment to reduce congestion. Reinforcing bars may be temporarily crowded to one side during concrete placement provided they are returned to exact required location before concrete placement and consolidation are completed.

3.6.7 Placing Flowable Concrete

If a plasticizing admixture conforming to ASTM C 1017 is used or if a Type F or G high range water reducing admixture is permitted to increase the slump, the concrete shall meet all requirements of paragraph GENERAL REQUIREMENTS in PART 1. Extreme care shall be used in conveying and placing the concrete to avoid segregation. Consolidation and finishing shall meet all requirements of paragraphs Placing Concrete, Finishing Formed Surfaces, and Finishing Unformed Surfaces. No relaxation of requirements to accommodate flowable concrete will be permitted.

3.7 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 2 inches clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 30 pound asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section \=07920=\ JOINT SEALING.

3.7.1 Construction Joints

For concrete other than slabs on grade, construction joints shall be located so that the unit of operation does not exceed 60 feet. Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 1 inch square-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 1 inch above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

3.7.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by use of rigid inserts impressed in the concrete during placing operations use of snap-out plastic joint forming inserts or sawing a continuous slot with a concrete saw. Regardless of method used to produce the weakened plane, it shall be 1/4 the depth of the slab thickness and between 1/8 and 3/16 inch wide. For saw-cut joints, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent ravelling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Reservoir for joint sealant shall be formed as previously specified.

3.7.3 Waterstops

Waterstops shall be installed in conformance with the locations and details shown on the drawings using materials and procedures specified in Section \=03250=\ EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.7.4 Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section \=03200=\ CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1/8 inch in 12 inches. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.8 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section \=03100=\ STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned

so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

3.8.1 Class C and Class D Finish

Class C finish is required **on concealed surfaces not exposed to view and not covered by a Class D finish**. Class D finish **may be used on foundation surfaces against which backfill will be placed**. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section \=03100=\ STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 1/2 inch deep or more than 2 inches in diameter shall be repaired. Defects more than 2 inches in diameter shall be cut back to sound concrete, but in all cases at least 1 inch deep.

3.9 REPAIRS

3.9.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 4 inches shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the No. 16 mesh sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

3.9.2 Repair of Major Defects

Major defects will be considered to be those more than 1/2 inch deep or,, for Class C and D finishes, more than 2 inches in diameter. Also included are any defects of any kind whose depth is over 4 inches or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

3.9.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose

the reinforcement for at least 2 inches on all sides. All such defective areas greater than 12 square inches shall be outlined by saw cuts at least 1 inch deep. Defective areas less than 12 square inches shall be outlined by a 1 inch deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-presure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

3.10 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

3.10.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 50 degrees F. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or

other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.10.2 Rough Slab Finish

As a first finishing operation for unformed surfaces, the surface shall receive a rough slab finish prepared as follows. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails. Forms and screed rails shall be set true to line and grade. "Wet screeds" shall not be used.

3.10.3 Floated Finish

Slabs to receive more than a rough slab finish shall next be given a wood float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 1/4 inch and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Lightweight concrete or concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

3.10.4 Troweled Finish

After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 3 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if

necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

3.10.5 Non-Slip Finish

Non-slip floors shall be constructed in accordance with the following subparagraphs.

3.10.5.1 Broomed

Exterior stairwell tread surfaces shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a hair or coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

3.11 FLOOR HARDENER

All exposed concrete floor surfaces shall be treated with floor hardener. Floor hardener shall be applied after the concrete has been cured and then air dried for 28 days. Three coats shall be applied, each the day after the preceding coat was applied. For the first application, one pound of the silocofluoride shall be dissolved in one gallon of water. For subsequent applications, the solution shall be two pounds of silicofluoride to each gallon of water. Floor should be mopped with clear water shortly after the preceding application has dried to remove encrusted salts. Proprietary hardeners shall be applied in accordance with the manufacturer's instructions. During application, area should be well ventilated. Precautions shall be taken when applying silicofluorides due to the toxicity of the salts. Any compound that contacts glass or aluminum should be immediately removed with clear water.

3.12 EXTERIOR SLAB AND RELATED ITEMS

3.12.1 Pavements

Pavements shall be constructed where shown on the drawings. After forms are set and underlying material prepared as specified, the concrete shall be placed uniformly throughout the area and thoroughly vibrated. As soon as placed and vibrated, the concrete shall be struck off and screeded to the crown and cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the required elevation. The entire surface shall be tamped with the strike off, or consolidated with a vibrating screed, and this operation continued until the required compaction and reduction of internal and surface voids are accomplished. Care shall be taken to prevent bringing excess paste to the surface. Immediately following the final consolidation of the surface, the pavement shall be floated longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, additional concrete shall be placed and screeded, and the float operated until a satisfactory surface has been produced. The floating operation shall be advanced not more than half the length of the float and then continued over the new and previously floated surfaces. After finishing is completed but while the concrete is still plastic, minor irregularities and

score marks in the pavement surface shall be eliminated by means of long-handled cutting straightedges. Straightedges shall be 12 feet in length and shall be operated from the sides of the pavement and from bridges. A straightedge operated from the side of the pavement shall be equipped with a handle 3 feet longer than one-half the width of the pavement. The surface shall then be tested for trueness with a 12 foot straightedge held in successive positions parallel and at right angles to the center line of the pavement, and the whole area covered as necessary to detect variations. The straightedge shall be advanced along the pavement in successive stages of not more than one-hal the length of the straightedge. Depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. The straightedge testing and finishing shall continue until the entire surface of the concrete is true. Before the surface sheen has disappeared and well before the concrete becomes nonplastic, the surface of the pavement shall be given a nonslip sandy surface texture by belting with approved "belt" and procedures or use of a burlap drag. A strip of clean, wet burlap from 3 to 5 feet wide and 2 feet longer than the pavement width shall be carefully pulled across the surface]. Edges and joints shall be rounded with an edger having a radius of 1/8 inch. Curing shall be as specified.

3.12.2 Sidewalks

Concrete shall be 4 inches minimum thickness. Contraction joints shall be provided at 5 feet spaces unless otherwise indicated. Contraction joints shall be cut 1 inch deep with a jointing tool after the surface has been finished. Transverse expansion joints 1/2 inch thick shall be provided at changes in direction and where sidewalk abuts curbs, steps, rigid pavement, or other similar structures. Sidewalks shall be given a lightly broomed finish. A transverse slope of 1/4 inch per foot shall be provided, unless otherwise indicated. Variations in cross section shall be limited to 1/4 inch in 5 feet.

3.12.3 Curbs and Gutters

Concrete shall be formed, placed, and finished by hand using a properly shaped "mule" or constructed using a slipform machine specially designed for this work. Contraction joints shall be cut 3 inches deep with a jointing tool after the surface has been finished. Expansion joints (1/2 inch wide) shall be provided at 100 feet maximum spacing unless otherwise indicated. Exposed surfaces shall be finished using a stiff bristled brush.

3.12.4 Pits and Trenches

Pits and trenches shall be constructed as indicated on the drawings. Bottoms and walls shall be placed monolithically or waterstops and keys, shall be provided as approved.

3.13 CURING AND PROTECTION

3.13.1 General

Concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
All other concrete	7 days

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

3.13.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

3.13.3 Membrane Forming Curing Compounds

Membrane forming curing compounds shall be used only on surfaces in the following areas; **vertical walls, sidewalks, and gradebeams**. Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete, including surfaces to which a smooth finish is to be applied or other concrete to be bonded. However, a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements, may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces

immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be thoroughly moistened with water. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 75 psi, at a uniform coverage of not more than 400 square feet per gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shll be resprayed by the method and at the coverage specified. Surfaces on which clear compound is used shall be shaded from direct rays of the sun for the first 3 days. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3.13.4 Impervious Sheeting

The following concrete surfaces may be cured using impervious sheets: **slabs**. However, except for plastic coated burlap, impervious sheeting alone shall not be used for curing. Impervious-sheet curing shall only be used on horizontal or nearly horizontal surfaces. Surfaces shall be thoroughly wetted and be completely covered with the sheeting. Sheeting shall be at least 18 inches wider than the concrete surface to be covered. Covering shall be laid with light-colored side up. Covering shall be lapped not less than 12 inches and securely weighted down or shall be lapped not less than 4 inches and taped to form a continuous cover with completely closed joints. The sheet shall be weighted to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Coverings shall be folded down over exposed edges of slabs and secured by approved means. Sheets shall be immediately repaired or replaced if tears or holes appear during the curing period.

3.13.5 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.

3.13.6 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 32 degrees F the temperature of the concrete shall be maintained above 40 degrees F for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 25 degrees F as determined by suitable temperature measuring devices furnished by the Government, as required, and installed adjacent to the concrete surface 2 inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed.

3.14 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar, except where nonshrink grout is indicated. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 3/4 inch. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed. Nonshrink grout shall be used for **column baseplates**.

3.14.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed. The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

3.14.2 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.14.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained at 65 to 85 degrees F until after setting.

3.14.2.2 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 1 inch and immediately covered with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with sufficient water to make a plastic mixture. The parge coat shall have a smooth finish. For other mortars or grouts, exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

3.15 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per **week** thereafter for conformance with ASTM C 1077. **All technicians sampling and testing concrete shall be ACI concrete field testing technicians Grade I certified. Testing lab personnel shall remain during entire concrete placement of operations over 50 cubic feet.**

3.15.1 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by ASTM C 33. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.15.2 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.15.3 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic yard, amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic yard for each class of concrete batched during each day's plant operation.

3.15.4 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.15.5 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.15.6 Vibrators

The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph Consolidation, shall be immediately removed from service and repaired or replaced.

3.15.7 Curing Inspection

a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.

b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.

c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area

of concrete surface covered, shall compute the rate of coverage in square feet per gallon, and shall note whether or not coverage is uniform.

d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.

f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

3.15.8 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.15.9 Mixer Uniformity

a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 75,000 cubic yards of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with ASTM C 94.

b. Truck Mixers. Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.

c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

3.15.10 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 04200

MASONRY

07/92

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

\-ACI SP-66-\	(1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 82-\	(1994) Steel Wire, Plain, for Concrete Reinforcement
\-ASTM A 153-\	(1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
\-ASTM A 615-\	(1995) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
\-ASTM C 67-\	(1994) Sampling and Testing Brick and Structural Clay Tile
\-ASTM C 90-\	(1995) Loadbearing Concrete Masonry Units
\-ASTM C 91-\	(1995) Masonry Cement
\-ASTM C 129-\	(1995) Nonloadbearing Concrete Masonry Units
\-ASTM C 140-\	(1995a) Sampling and Testing Concrete Masonry Units
\-ASTM C 216-\	(1995) Facing Brick (Solid Masonry Units Made from Clay or Shale)
\-ASTM C 270-\	(1995) Mortar for Unit Masonry
\-ASTM C 476-\	(1991) Grout for Masonry
[AM#1] \-ASTM C 494-\	(1992) Chemical Admixtures for Concrete
\-ASTM C 578-\	(1992) Rigid, Cellular Polystyrene Thermal Insulation

\-ASTM C 641-\	(1982; R 1991) Staining Materials in Lightweight Concrete Aggregates
\-ASTM C 780-\	(1994) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
\-ASTM C 1019-\	(1989a; R 1993) Sampling and Testing Grout
\-ASTM C 1072-\	(1994) Measurement of Masonry Flexural Bond Strength
[AM#1] \-ASTM C 1209-\	(1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
\-ASTM D 2000-\	(1990; R 1994) Rubber Products in Automotive Applications
\-ASTM D 2240-\	(1991) Rubber Property - Durometer Hardness
\-ASTM D 2287-\	(1992) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
\-ASTM E 119-\	(1995a) Fire Tests of Building Construction and Materials

1.2 SUBMITTALS

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

SD-01 Data\

Clay or Shale Brick\; *GA*\.

[AM#1]
Insulation\; *GA*\.

Manufacturer's descriptive data.

SD-04 Drawings\

Masonry Work\; *GA*\.

Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; and wall openings. Bar splice locations shall be shown. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the

shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1/4 inch per foot. Reinforcement bending details shall conform to the requirements of \-ACI SP-66-\.

SD-08 Statements\

Cold Weather Installation\; *GA*\.

Cold weather construction procedures.

SD-09 Reports\

Efflorescence Test\; *GA*\.

Field Testing of Mortar\; *GA*\.

Field Testing of Grout\; *GA*\.

[AM#1]

Masonry Cement\; *GA*\.

Fire-rated CMU\; *GA*\.

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

Special Inspection\; *GA*\.

Copies of masonry inspector reports.

SD-13 Certificates\

Clay or Shale Brick\; *FIO*\.

Concrete Masonry Units (CMU)\; *FIO*\.

Control Joint Keys\; *FIO*\.

Anchors, Ties, and Bar Positioners\; *FIO*\.

Expansion-Joint Materials\; *FIO*\.

Joint Reinforcement\; *FIO*\.

Reinforcing Steel Bars and Rods\; *FIO*\.

Masonry Cement\; *FIO*\.

Mortar Coloring\; *FIO*\.

Insulation\; *FIO*\.

[AM#1]
Precast Concrete Items\; *FIO*\.
Mortar Admixtures\; *FIO*\.

Grout Admixtures\; *FIO*\.

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

SD-14 Samples\

Concrete Masonry Units (CMU)\; *GA*\.

[AM#1]

Clay or Shale Brick\; *GA*\.

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

Anchors, Ties, and Bar Positioners\; *GA*\.

Two of each type used.

Expansion-Joint Material\; *GA*\.

One piece of each type used.

Joint Reinforcement\; *GA*\.

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

Insulation\; *GA*\.

One piece of board type insulation, not less than \~16 inches~\ by \~24 inches~\ in size, containing the label indicating the rated permeance and R-values.

Portable Panel\; *GA*\.

One panel of clay or shale brick, \~2 feet by 2 feet,~\ containing approximately 24 brick facings to establish range of color and texture.

1.3 SAMPLE MASONRY PANELS

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

1.3.1 Configuration

Panels shall be L-shaped or otherwise configured to represent all of the wall elements. Panels shall be of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. The minimum size of a straight panel or a leg of an L-shaped panel shall be \~8 feet long~\ by \ 6 feet high.~\

1.3.2 Composition

Panels shall show full color range, texture, and bond pattern of the masonry work. The Contractor's method for mortar joint tooling; grouting of reinforced vertical cores, collar joints, bond beams, and lintels; positioning, securing, and lapping of reinforcing steel; positioning and lapping of joint reinforcement (including prefabricated corners); and cleaning of masonry work shall be demonstrated during the construction of the panels. Installation or application procedures for anchors, wall ties, [AM#1] _____ CMU control joints, brick expansion joints, insulation, flashing, brick soldier, row lock courses and weep holes shall be shown in the sample panels. The panels shall contain a masonry bonded corner that includes a bond beam corner. Panels shall show installation of electrical boxes and conduit. Panels that represent reinforced masonry shall contain a \~2 foot by 2 foot~\ opening placed at least \~2 feet~\ above the panel base and \~2 feet~\ away from all free edges, corners, and control joints. Required reinforcing shall be provided around this opening as well as at wall corners and control joints.

1.3.3 Construction Method

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

1.3.4 Usage

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

1.4 DELIVERY, HANDLING, AND STORAGE

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

1.4.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather and shall conform to the moisture content as specified in \-ASTM C 90-\ when delivered to the jobsite. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.4.2 Reinforcement, Anchors, and Ties

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

1.4.3 Cementitious Materials, Sand and Aggregates

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

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

2.2 *CLAY OR SHALE BRICK*\

Color range and texture of clay or shale brick shall be as indicated in Section 09000: BUILDING COLOR AND FINISH SCHEDULE and shall conform to the approved sample. Grade SW shall be used for brick in contact with earth or grade and for all exterior work. Brick shall be tested for efflorescence. Clay or shale brick units shall be delivered factory-blended to provide a uniform appearance and color range in the completed wall.

[AM#1]
2.2.1 _____ Clay or Shale Brick

[AM#1]
_____Clay or shale shall conform to \-ASTM C 216-\, Type FBS. Brick size shall be modular and the nominal size of the brick used shall be 3 5/8 inches thick, 2 1/4 inches wide, and 7 5/8 inches long. Minimum compressive strength of the brick shall be 2500 psi.

2.3 *CONCRETE MASONRY UNITS (CMU)*\

[AM#1]

Hollow and solid concrete masonry units shall conform to \-ASTM C 90-\, Type I, Medium weight _____. Cement shall have a low alkali content and be of one brand.

2.3.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with \-ASTM C 641-\: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2.3.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be \~1 inch.~\ Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

2.4 PRECAST CONCRETE ITEMS

Lintels and splashblocks shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be \~4,000 psi~\ minimum conforming to Section \=03300=\ CAST-IN-PLACE STRUCTURAL CONCRETE using \~1/2 inch~\ to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Clearance of \~3/4 inch~\ shall be maintained between reinforcement and faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least \~120 pounds per square inch~\ for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days or longer. Cast-concrete members weighing over \~80 pounds~\ shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

2.4.1 Lintels

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

2.4.2 Splash Blocks

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

2.5 MORTAR

Mortar shall be Type S in accordance with the proportion specification of \-ASTM C 270-\ except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; when masonry cement \-ASTM C 91-\ is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Evaluation of performance shall be based on \-ASTM C 780-\ and \-ASTM C 1072-\. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.5.1 Admixtures

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

2.5.2 Coloring

Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color as indicated in Section 09000: BUILDING FINISH AND COLOR SCHEDULE. Mortar coloring shall not exceed 3 percent of the weight of cement for carbon black and ten percent of the weight of cement for all other pigments. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement.

2.6 GROUT

Grout shall conform to \-ASTM C 476-\. Cement used in grout shall have a low alkali content. Grout slump shall be between \~8 and 10 inches.~\ Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

2.6.1 Admixtures

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

2.6.2 Grout Barriers

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

2.7 *ANCHORS, TIES, AND BAR POSITIONERS*\

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with \-ASTM A 153-\, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to \-ASTM A 82-\. Anchors and ties shall be sized to provide a minimum of \~5/8 inch~\ mortar cover from either face.

[AM#1]

2.7.1 Wall Ties

Wall ties shall be rectangular shaped of Z shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4-inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 3/16 inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 1/2-inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16-inch. The pintle and eye elements shall be formed so that both can be in the same plane.

2.7.2 Adjustable Anchors

Adjustable anchors shall be \~3/16 inch~\ diameter steel wire, triangular-shaped. Anchors attached to steel shall be \~5/16 inch~\ diameter steel bars placed to provide \~1/16 inch~\ play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

2.7.3 Bar Positioners

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

2.8 *JOINT REINFORCEMENT*

Joint reinforcement shall be factory fabricated from steel wire conforming to \-ASTM A 82-\, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to \-ASTM A 153-\, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of \~5/8 inch~\ cover from either face. The distance between crosswires shall not exceed \~16 inches.~\ Joint reinforcement for straight runs shall be furnished in flat sections not less than \~10 feet~\ long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

2.9 *REINFORCING STEEL BARS AND RODS*

Reinforcing steel bars and rods shall conform to \-ASTM A 615-\, Grade 60.

2.10 *CONTROL JOINT KEYS*

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to \-ASTM D 2000-\ or polyvinyl chloride conforming to \-ASTM D 2287-\. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than \~5/8 inch~\ thick and \~3/8 inch~\ thick flanges, with a tolerance of plus or minus \ \~1/16 inch.~\ The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of \~minus 30 degrees F~\ after five hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with \-ASTM D 2240-\.

2.11 *EXPANSION-JOINT MATERIALS*

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section \=07920=\ JOINT SEALING.

2.12 *INSULATION*

2.12.1 Rigid Board-Type Insulation

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

2.12.1.1 Insulation Thickness and Air Space

[AM#1]
The cavity space shall allow for a maximum insulation thickness of one inch.

[AM#1]
2.12.1.2 _____ R-Value

The insulation shall provide a minimum R-value of <u>four</u>. The stated R-value of the insulation shall be certified by an independent testing laboratory or certified by an independent Registered Professional Engineer if tests are conducted in the manufacturer's laboratory.

2.12.2 Insulation Adhesive

Insulation adhesive shall be specifically prepared to adhere the insulation to the damprofing as specified. The adhesive shall not deleteriously affect the insulation, and shall have a record of satisfactory and proven performance for the conditions under which to be used.

2.13 FLASHING

Flashing shall be as specified in Section \=07600=\ SHEET METALWORK, GENERAL.

2.14 WEEP HOLE VENTILATORS

Weephole ventilators shall be prefabricated aluminum grill type vents designed to prevent insect entry with maximum air entry. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint.

[AM#1]
2.15 MORTAR COLLECTION DEVICE

Mortar collection device shall be manufactured of high desity polyethylene, nylon or recycled poluester 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 weep holes.

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than \~99 degrees F~\ in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than \~4 feet~\ ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 *Cold Weather Installation*

Before erecting masonry when ambient temperature or mean daily air temperature falls below \~40 degrees F,~\ a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

3.1.2.1 Preparation

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

a. Air Temperature \~40 to 32 Degrees F.~\ Sand or mixing water shall be heated to produce mortar temperatures between \~40 degrees F and 120 degrees F.~\

b. Air Temperature \~32 to 25 Degrees F.~\ Sand and mixing water shall be heated to produce mortar temperatures between \~40 degrees F and 120 degrees F.~\ Temperature of mortar on boards shall be maintained above freezing.

c. Air Temperature \~25 to 20 Degrees F.~\ Sand and mixing water shall be heated to provide mortar temperatures between \~40 degrees F and 120 degrees F.~\ Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of \~15 mph.~\

d. Air Temperature \~20 Degrees F~\ and below. Sand and mixing water shall be heated to provide mortar temperatures between \~40 degrees F and 120 degrees F.~\ Enclosure and auxiliary heat shall be provided to maintain air temperature above \~32 degrees F.~\ Temperature of units when laid shall not be less than \~20 degrees F.~\

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

a. Mean daily air temperature \~40 degrees F to 32 degrees F.~\ Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

b. Mean daily air temperature \~32 degrees F to 25 degrees F.~\ Masonry shall be completely covered with weather-resistant membrane for 24 hours.

c. Mean Daily Air Temperature \~25 Degrees F to 20 Degrees F.~\ Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.

d. Mean Daily Temperature \~20 Degrees F~\ and Below. Masonry temperature shall be maintained above \~32 degrees F~\ for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.2 LAYING MASONRY UNITS

Brick masonry units shall be laid in running bond pattern with soldier cousing as indicated. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus \~1/2 inch.~\ Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be free from chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to \~1/2 inch~\ into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. In double wythe construction, the inner wythe may be brought up not more than \~16 inches~\ ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the

laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than ^\ \~8 inches.~\

3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least \~1/8 inch.~\ Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.2 Forms and Shores

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

3.2.3 Concrete Masonry Units

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

3.2.4 Clay or Shale Brick Units

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

3.2.4.1 Wetting of Units

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

3.2.4.2 Solid Units

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

3.2.4.3 Hollow Units

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

3.2.5 Tolerances

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

\~

TABLE II

TOLERANCES

Variation from the plumb in the lines and surfaces of columns, walls and arises	
In adjacent masonry units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch
Variations from the plumb for external corners, expansion joints, and other conspicuous lines	
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch
Variations from the level for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch
Variation from level for bed joints and top surfaces of bearing walls	
In 10 feet	1/4 inch
In 40 feet or more	1/2 inch
Variations from horizontal lines	
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch
Variations in cross sectional dimensions of	

columns and in thickness of walls

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

3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over \~12 inches~\ wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.7 Jointing

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

3.2.7.1 Flush Joints

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

3.2.7.2 Tooled Joints

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

3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of \~3/8 inch.~\ On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of \~3/8 inch.~\

3.2.8 Joint Widths

Joint widths shall be as follows:

3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have \~3/8 inch~\ joints .

3.2.8.2 Brick

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

3.2.9 Embedded Items

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

3.2.10 Unfinished Work

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

3.2.11 Masonry Wall Intersections

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

3.2.12 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately \~4 inches~\ above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Interior partitions having \~4 inch~\ nominal thick units shall be tied to intersecting partitions of \~4 inch~\ units, \~5 inches~\ into partitions of ^\ \~6 inch~\ units, and \~7 inches~\ into partitions of \~8 inch~\ or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units may be used. Interior partitions having masonry walls over \~4 inches~\ thick shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

3.3 ANCHORED VENEER CONSTRUCTION

The inner and outer wythes shall be completely separated by a continuous airspace as shown on the drawings. Both the inner and the outer wythes shall be laid up together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, through-wall flashings shall be protected from damage until they are fully enclosed in the wall. The airspace between the wythes shall be kept clear and free of mortar droppings by temporary wood strips laid on the wall ties and carefully lifted out before placing the next row of ties. A coarse gravel or drainage material shall be placed behind the weep holes in the cavity to a minimum depth of 4 inches of coarse aggregate or 10 inches of drainage material to keep mortar droppings from plugging the weep holes. A mat for this purpose may be substituted with approval of contacting officer.

3.4 WEEP HOLES

Weep holes shall be provided not more than 24 incheson centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be constructed using weep hole ventilators. Weep holes shall be kept free of mortar and other obstructions.

[AM#1]
3.4.1 MORTAR COLLECTION DEVICE

Mortar collection device shall be installed over all through wall flashoing per manufacturers written instructions.

3.9 MORTAR

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

3.10 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within \~2 inches~\ of tops of walls.

3.10.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of \~1/2 inch~\ shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical

reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.10.2 Splices

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

3.11 JOINT REINFORCEMENT

Joint reinforcement shall be installed at \~16 inches~\ on center or as indicated. Reinforcement shall be lapped not less than \~6 inches.~\ Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than \~5/8 inch~\ cover to either face of the unit.

3.12 PLACING GROUT

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

3.12.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than \~30 feet~\ apart, or as required, to limit the horizontal flow of grout for each pour.

3.12.2 Horizontal Grout Barriers

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

3.12.3 Grout Holes and Cleanouts

3.12.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than \~16 inches~\ on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings

shall not be less than \~4 inches~\ in diameter or \~3 by 4 inches~\ in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.12.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds \~5 feet.~\ Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of \~32 inches~\ where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than \~3 by 4 inch~\ openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

3.12.4 Grouting Equipment

3.12.4.1 Grout Pumps

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

3.12.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

3.12.5 Grout Placement

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

3.12.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than \~1/2 inch~\ into the grout space shall be removed before beginning the grouting operation. Grout pours \~12 inches~\ or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over \~12 inches~\ in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

3.12.5.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than \~1/4 inch~\ into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to \~4 feet~\ in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated \~12 to 18 inches~\ into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

\^
\~

TABLE II

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (feet) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2)	
			Multiwythe Masonry (3)	Hollow-unit Masonry
1	Fine	Low Lift	3/4	1-1/2 x 2
5	Fine	Low Lift	2	2 x 3
8	Fine	High Lift	2	2 x 3

12	Fine	High Lift	2-1/2	2-1/2 x 3
24	Fine	High Lift	3	3 x 3
1	Coarse	Low Lift	1-1/2	1-1/2 x 3
5	Coarse	Low Lift	2	2-1/2 x 3
8	Coarse	High Lift	2	3 x 3
12	Coarse	High Lift	2-1/2	3 x 3
24	Coarse	High Lift	3	3 x 4~\

Notes:
(1) The actual grout space or cell dimension must be larger than the sum of the following items:

a) The required minimum dimensions of total clear areas given in the table above;

b) The width of any mortar projections within the space;

c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.

(2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being \~3/4 inch~\ or greater in width.

(3) For grouting spaces between masonry wythes.

(4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.13 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of \~1/2 inch~\ shall be maintained between reinforcement and interior faces of units.

3.14 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using special control-joint units and/or sash jamb units with control joint key in accordance with the details shown on the drawings. Sash jamb units shall have a \ \~3/4 by 3/4 inch~\ groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of \~3/4 inch;~\ backer rod and sealant shall be installed in accordance with Section \=07920=\ JOINT SEALING. Exposed interior control joints shall be raked to a depth of \~1/4 inch.~\ Concealed control joints shall be flush cut.

3.15 BRICK EXPANSION JOINTS AND CONCRETE MASONRY VENEER JOINTS

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

3.16 SHELF ANGLES

Shelf angles shall be adjusted as required to keep the masonry level and at the proper elevation. Shelf angles shall be galvanized. Shelf angles shall be provided in sections not longer than \~10 feet~\ and installed with a \~1/4 inch~\ gap between sections. Shelf angles shall be mitered and welded at building corners with each angle not shorter than \~4 feet,~\ unless limited by wall configuration.

3.17 LINTELS

3.17.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or \~24 inches,~\ whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located \~1/2 inch~\ above the bottom inside surface of the lintel unit.

3.17.2 Precast Concrete and Steel Lintels

Precast concrete and steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of \~8 inches~\ unless otherwise indicated on the drawings.

3.18 SILLS AND COPINGS

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

3.19 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.19.1 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over \~16 inches~\ on centers vertically, and if applicable, not over \~24 inches~\ on centers horizontally.

3.20 INSULATION

Anchored veneer walls shall be insulated, where shown, by installing board-type insulation on the cavity side of the inner wythe. Board type insulation shall be applied directly to the damproofing with adhesive. Insulation shall be neatly fitted between obstructions without impaling of insulation on ties or anchors. The insulation shall be applied in parallel courses with vertical joints breaking midway over the course below

and shall be applied in moderate contact with adjoining units without forcing, and shall be cut to fit neatly against adjoining surfaces.

3.21 SPLASH BLOCKS

Splash blocks shall be located At all downspouts.

3.22 POINTING AND CLEANING

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

3.22.1 Concrete Masonry UnitSurfaces

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

3.22.2 Clay or Shale Brick Surfaces

Exposed clay or shale brick masonry surfaces shall be cleaned as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, the sample panel of similar material shall be examined for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, the method of cleaning shall be changed to assure that the masonry surfaces in the structure will not be adversely affected. The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned\~1/2 cup~\ trisodium phosphate and \~1/2 cup~\ laundry detergent to \~one gallon~\ of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

3.23 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar

and non-shrink grout shall be as specified in Section \=03300=\ CAST-IN-PLACE STRUCTURAL CONCRETE.

3.24 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of \~2 feet~\ down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.25 TEST REPORTS

3.25.1 *Field Testing of Mortar*\

At least three specimens of mortar shall be taken each day. A layer of mortar \~1/2 to 5/8 inch~\ thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with \-ASTM C 780-\.

3.25.2 *Field Testing of Grout*\

Field sampling and testing of grout shall be in accordance with the applicable provisions of \-ASTM C 1019-\. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of \~2000 psi~\ at 28 days.

3.25.3 *Efflorescence Test*\

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

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

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

\-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" desigJunen; 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 SG-671-\. 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 M016-\. 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-03-\. 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 \^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] <u>and spaced at 16-inches on center</u>. 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

Insulation placed between the steel studs shall be batt or blanket type mineral wool conforming to \-ASTM C 665-\, Type III, with an R-19 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

Gypsum sheathing that is installed on the exterior side of the cold-formed steel framing system shall have a minimum thickness of \~1/2 inch~\ and shall be \~4 feet~\ wide. Gypsum sheathing shall conform to \-ASTM C 79-\. 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 \~15-lb~\ asphalt-saturated felt conforming to \-ASTM D 226-\ Type I (No. 15).

2.8.2 Vapor Retarder

The vapor retarder shall be polyethylene film conforming to \-ASTM D 2103-\, \~6 mil~\ 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 \~1-1/4 inch~\ from each face of the masonry veneer. Anchors wires shall not have drips. Wires for veneer anchors shall be rectangular or triangular hoops formed from \~3/16 inch~\ diameter steel wire conforming to \-ASTM A 82-\. Anchor assemblies including wires and anchor plates shall be hot-dip galvanized conforming to \-ASTM A 153-\, 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 \~2000 pounds per inch~\(or a deflection of \~0.05 inches per 100 pounds~\ of load in tension or compression). In the direction perpendicular to the masonry veneer, the anchor assembly shall have a maximum play of \~1/16 inch.~\

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 \~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. Studs shall be spaced 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 angles segments shall not be connected together but instead shall be installed with \~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 \-AISC-03-\.

3.4 INSULATION

The actual installed thickness of insulation shall provide a maximum thermal R of 19 as determined in accordance with \-ASHRAE-03-\. 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 \=09250=\ GYPSUM WALLBOARD except at vertical slip joints, the gypsum wallboard shall be connected to the vertical studs only so as not to prevent movement at the slip joint.

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 \~3/8 inch~\ from the ends and edges of sheathing panels and shall be spaced not more than \~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 \~6 inches~\ over the sheet below. Vertical end joints shall be lapped not less than \~6 inches~\ and shall be staggered. Attachment of the moisture barrier shall be with staples spaced not greater than \~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 \~5/8 inch~\ 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 \~two square feet~\ of wall and shall be attached to steel studs and other supports with a maximum spacing of \~24 inches~\ on center. For pintle-eye anchors the vertical distance between the pintle section horizontal wires and the eye section horizontal wires shall not exceed \~1/2 inch.~

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 \=07600=\ SHEET METALWORK, GENERAL. Flashing shall be lapped a minimum of \~6 inches~\ 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 \ \~6 inches~\ 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 \~[2] [_____] inch~\ 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 \~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 \~120 degrees F~\ when laid. Masonry erected when the ambient air temperature is more than \~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 \~40 degrees F~\ when laid. When the ambient air temperature is \~32 degrees F~\ or less, masonry veneer under construction shall be protected and maintained at a temperature greater than \~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.

\~ TABLE I

Variation From Plumb	
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	
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	
In 20 feet	1/2 inch
In 40 feet or more	3/4 inch
Variation From Cross Sectional Dimensions Of Walls	

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 \~1/4 inch~\ nor more than \~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 \~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 \~6 inches.~\ Joint reinforcement must be discontinuous at all veneer joints. The minimum cover for joint reinforcement is \~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.

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. Toothing 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.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 04735

CAST STONE

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.

Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

AMERICAN CONCRETE INSTITUTE (ACI)

\-ACI 318M/318RM-\	(1989; Rev 1992) Building Code Requirements for Reinforced Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 33-\	(1992a) Specification for Concrete Aggregates.
\-ASTM C 150-\	(1994) Specification for Portland Cement.
\-ASTM A 270-\	(1990) Seamless and Welded Austenitic Stainless Steel Sanitary Tubing
\-ASTM C 494-\	(1992) Specification for Concrete Admixtures.
\-ASTM A 615-\	(1993) Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
\-ASTM A 642-\	(1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Drawing Quality, Special Killed
\-ASTM C 979-\	(1982; R 1993) Coloring Pigments for Integrally Pigmented Concrete.
\-ASTM C 1194-\	Test Method for Compressive Strength of Architectural Cast Stone.
\-ASTM C 1195-\	Test Method for Absorption of Architectural Cast Stone.
\-ASTM D 2244-\	(1993) Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates.

CAST STONE INSTITUTE (CS)

\-CS-01-\	(Current Edition) Cast Stone Institute Technical Manual.

1.2 SUBMITTALS

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

SD-04 Drawings\

Cast Stone\; *FIO*\.

Shop Drawings: Submit for approval the following:

a. Copies of shop drawings showing details of the stone to be provided including: profiles, cross-sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, annotation of stone types and their location.

b. Unless otherwise shown on contract drawings:

(1) Provide suitable wash on all exterior sills, coping, projecting courses and pieces with exposed top surfaces.

(2) Provide drips as needed.

SD-13 Samples\

Cast Stone\; *GA*\.

Submit for approval the following:

a. Samples of the Cast Stone specified which will be representative of the general range of color and finish to be furnished.

b. Test results of Cast Stone previously made by the manufacturer.

1.3 QUALITY ASSURANCE

1.3.1 Qualification of manufacturer

a. Shall be a current producer member of the Cast Stone Institute.

b. The Manufacturer shall have a minimum of five years of continuous operation, having experience, adequate facilities and capacity to furnish the quality, sizes and quantity of cast stone required without delaying the progress of the work, and whose products have been previously used and exposed to the weather with satisfactory results.

1.3.2 All cast stone used in this work shall be manufactured by the same manufacturer.

1.3.3 Testing

Test compressive strength and absorption of three specimens per 500 cubic feet at random from plant production in accordance with referenced standards.

1.4 MOCK-UP

Provide full size unit(s) for use in construction of sample wall. The mock-up becomes the standard of workmanship for the project.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Architectural Cast Stone

Physical properties

Provide the following:

a. Compressive Strength, ASTM C 1194: 6500 psi min. for products at 28 days. or;

b. Absorption, ASTM C 1195 or ASTM C642: 6% max. for products at 28 days.

c. Divide results of field cut specimens by .8 to determine minimum compressive strength requirements.

2.1.2 Raw materials:

2.1.2.1 Portland cement

Type I or m, white and/or grey, ASTM C 150.

2.1.2.2 Coarse aggregates

Granite, quartz or limestone, ASTM C 33, except for gradation.

2.1.2.3 Fine aggregates

Manufactured or natural sands, ASTM C 33, except for gradation.

2.1.2.4 Colors

Inorganic iron oxide pigments, ASTM C 979.

2.1.2.5 Admixtures

ASTM C 494.

2.1.2.6 Water

Potable.

2.2 COLOR AND FINISH

2.2.1. Color [AM#1] <u>of cast stone and mortar</u> shall be as indicated in SECTION 09000: BUILDING COLOR & FINISH SCHEDULE.

2.2.2 Exposed surfaces, unless otherwise specified, shall exhibit a fine "rained texture similar to that of natural stone. No bugholes or air voids will be permitted.

2.2.3 Variation:

Must match color and finish of approved sample subjected to similar aging and weathering conditions when viewed in direct daylight at a 10 foot distance.

ASTM. color variation allowed - 2%, hue, 6% lightness, chrome and hue combined.

2.3 CURING AND FINISHING

a. Cast stone shall be cured with a direct fired steam generator at a minimum temperature of 105 degrees F for a minimum of 6 hours within 12 hours of product fabrication. Curing shall be performed in the presence of CO and CO_2 to promote carbonation at the surface of the product for efflorescence control.

b. Remove cement film from exposed surfaces prior to packaging for shipment.

2.4 REINFORCING

2.4.1 New billet steel reinforcing bars - ASTM A615:

a. Reinforce units when necessary for handling and structural stresses.

b. Reinforcement shall be galvanized or epoxy coated when covered with less than 1-1/2 inches of material.

c. Area of reinforcement in panels shall be not less than 1/4 of one percent of the cross section area and otherwise as required by ACI 318 Building Code Requirements for Reinforced Concrete.

2.5 RELATED MATERIALS

2.5.1 Anchors

Non-corrosive; galvanized, brass or stainless steel type 304.

2.5.2 Mortar

Type N. ASTM C 270.

PART 3 EXECUTION

3.1 TOLERANCES

a. Comply with Cast Stone Institute Technical Manual (current edition).

b. Set stones 1/8-inch or less, within plane of adjacent unit.

c. Joints, +1/16 inch, -1/8 inch.

3.2 JOINTING

3.2.1 Joint size

a. At stonel brick joints - 3/8 inch.

b. At stone/stone joints in vertical position 1/4-inch (3/8-inch optional).

c. Stone/stone joints exposed on top side 3/8-inch.

3.2.2 Joint material

a. Use a full bed of mortar at all bed joints.

b. Flush vertical joints full with mortar.

c. Leave all joints with exposed tops or under relieving angles open for sealant.

3.2.3 Location of Joints

a. As shown on approved shop drawings.

b. Unless otherwise shown: at control and expansion joints per plans.

3.3 SETTING

a. Drench stones with clear, running water just prior to setting.

b. Fill all dowel holes and anchor slots completely with mortar or non-shrink grout.

c. Set all stones in a full bed of mortar unless otherwise detailed. Leave head joints in coping and similar stones open for sealant.

d. Rake mortar joints 3/4" for pointing. Sponge the face of each stone to remove excess mortar.

e. Tuck point stone joints to a slight concave profile.

f. Sealant joints - Prime the ends of stones, insert properly sized foam backup rod and gun-in sealant.

g. Protect stone while on ground (and after setting) from splashing, mortar and damage from other trades.

3.4 CLEANING AND REPAIR
[AM#1]
a. Clean stone by wetting with clear <u>running</u> water and applying a solution of "Sure Clean #600" by ProSoCo Products, Inc. or equal. Follow manufacturer's instructions.

b. Repair obvious chips with touchup material furnished by the manufacturer.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 05500

MISCELLANEOUS METAL

08/94

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

\-AA DAF-45-\	(1980) Designation System for Aluminum Finishes
\-AA SAA-46-\	(1978) Standards for Anodized Architectural Aluminum

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI A14.3-\	(1992) Ladders - Fixed - Safety Requirements
\-ANSI MH28.1-\	(1982) Design, Testing, Utilization, and Application of Industrial Grade Steel Shelving

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 36-\	(1994a) Carbon Structural Steel
\-ASTM A 53-\	(1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
\-ASTM A 123-\	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
\-ASTM A 283-\	(1993a) Low and Intermediate Tensile Strength Carbon Steel Plates
\-ASTM A 467-\	(1993) Machine and Coil Chain
\-ASTM A 475-\	(1995) Zinc-Coated Steel Wire Strand
\-ASTM A 500-\	(1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
\-ASTM A 653-\	(1995) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

\-ASTM A 924-\	(1995) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
\-ASTM B 26-\	(1995) Aluminum-Alloy Sand Castings
\-ASTM B 221-\	(1995a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
\-ASTM B 429-\	(1995) Aluminum-Alloy Extruded Structural Pipe and Tube
\-ASTM D 2047-\	(1993) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine

AMERICAN WELDING SOCIETY (AWS)

\-AWS D1.1-\	(1994) Structural Welding Code - Steel

COMMERCIAL ITEM DESCRIPTIONS (CID)

\-CID A-A-344A-\	(1984) Lacquer (Clear Gloss)

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

\-NAAMM MBG 531-\	(1988; MBG 531S-89) Metal Bar Grating Manual
\-NAAMM MBG 532-\	(1988) Heavy Duty Metal Bar Grating Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 211-\	(1992) Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances

1.2 SUBMITTALS

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

SD-04 Drawings\

Miscellaneous Metal Items\; *FIO*\.

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items: (a) access doors and frames; (b) exhaust vents; (c) down spout boots; (d) expansion-joint covers; (e)floor plates; (f)handrails; (g) guy cables; (h) ladders;(i) miscellaneous; (j) roof hatches; (k) safety nosing; (l) steel stairs; (m) trench covers, frames, and liners; (n) roll-up floor mats. [AM#1] <u>(o) Mechanical Yard Screens</u>.

SD-14 Samples\

Miscellaneous Metal Items\; *GA*\.

Samples of the following items:

(a) access doors and frames;
(b) exhaust vents;
(c) down spout boots;
(d) expansion-joint covers;
(e)floor plates;
(f)handrails;
(g) guy cables;
(h) ladders;
(i) miscellaneous;
(j) roof hatches;
(k) safety nosing;
(l) steel stairs;
(m) trench covers, frames, and liners;
(n) roll-up floor mats.
[AM#1]
(o) mechanical yard screens

Samples shall be full size, taken from manufacturer's stock, and shall be complete as required for installation in the structure. Samples may be installed in the work, provided each sample is clearly identified and its location recorded.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with \-AWS D1.1-\. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with \-ASTM A 123-\, \-ASTM A 653-\, or \-ASTM A 924-\, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth

finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

PART 2 PRODUCTS

2.1 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have anodized finish conforming to \-AA SAA-46-\. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in \-AA DAF-45-\. Items to be anodized shall receive a polished satin finish] Aluminum surfaces to be in contact with plaster or concrete during construction shall be protected with a field coat of \-CID A-A-344A-\.

2.2 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

2.3 ACCESS DOORS AND PANELS

Doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 16 gauge steel with welded joints and finished with anchorage for securing into construction. Access doors shall be a minimum of 14 by 20 inches and of not lighter than\~14 gauge~\ steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame and provided with a flush face, screw driver operated latch. Exposed metal surfaces shall have a shop applied prime coat.

2.4 EXHAUST VENTS

Vent frame and blades shall be of extruded aluminum not less than 1/8" thick. Blades shall be spaced at 1" and at a 45 degree angle. Provide maximum against water entering building. Color shall be as specified in Section 09000, BUILDING COLOR AND FINISH SCHEDULE. An insect screen with aluminum mesh of 18 x 16 strands per inch shall be proveded.

2.5 PIPE GUARDS

[AM#1]

Pipe guards shall be heavy duty steel pipe conforming to \-ASTM A 53-\, Type E or S, weight STD, prime finish.

[AM#1]

2.6 DRAIN BOOTS

Drain boots shall be cast cast brass with threaded inlet, insect screen and flasnge to secure to wall. Install per manufacturers written instructions.

2.7 EXPANSION JOINT COVERS

Expansion joint covers shall be constructed of extruded aluminum with anodized satin finish for walls and ceilings and with standard mill finish for floor covers and exterior covers. Plates, backup angles, expansion filler strip and anchors shall be designed as indicated. Expansion joint system shall provide a ONE hour fire rating.

2.8 FLOOR GRATINGS AND FRAMES

Aluminum grating shall be designed in accordance with [\-NAAMM MBG 531-\] [\-NAAMM MBG 532-\] to meet the indicated load requirements. Edges shall be banded with bars 1/4 inch less in height than bearing bars for grating sizes above 3/4 inch. Banding bars shall be flush with the top of bearing grating. Frames shall be of welded steel construction finished to match the grating. Floor gratings and frames shall be aluminum, mill finish fabrication.

2.9 FLOOR PLATES

Floor plates shall be 1/4 inch thick, raised thread steel galvanized.

2.10 HANDRAILS/GUARDRAILS

Handrails/Guardrails shall be designed to resist a concentrated load of \~200 pounds~\ in any direction at any point of the top of the rail or \~20 pounds per foot~\ applied horizontally to top of the rail, whichever is more severe.

2.10.1 Steel Handrails/Guardrails, Including Carbon Steel Inserts

Steel handrails/Guardrails, including inserts in concrete, shall be steel pipe conforming to \-ASTM A 53-\ and structural tubing conforming to \-ASTM A 500-\, Grade A or B of equivalent strength. Steel railings shall be as idicated on drawings \^ nominal size. Railings shall be hot-dip galvanized. Color shall be as indicated in section 09000; BUILDING COLOR AND FINISH SCHEDULE.

Fabrication: Joint posts, rail, and corners shall be fabricated by one of the following methods:

(1) Flush type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with \~3/8 inch~\ hexagonal recessed-head setscrews.

(2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than \~6 inches~\ long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

2.11 GUY CABLES

Guy cables shall be prestretched, galvanized wire rope of the sizes indicated. Wire rope shall conform to \-ASTM A 475-\, high strength grade with Class A coating. Guys shall have a factory attached clevis top-end fitting; guys shall have a factory attached open-bridge strand socket bottom-end fitting; guys shall be complete with oval eye, threaded anchor rods. Fittings and accessories shall be hot-dip galvanized.

2.12 LADDERS

Ladders shall be galvanized steel , fixed rail type in accordance with \-ANSI A14.3-\.

2.13 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

2.14 ROLL-UP FLOOR MATS

Roll-up mats shall be of aluminum construction with carpet surface. Roll-up mats shall be for use in recessed area. Construction details of recessed areas shall be shown on the drawings.

2.15 ROOF HATCHES

Roof hatches shall be of galvanized steel not less than 14 gauge with 3 inch beaded flange welded and ground at corners. Hatches shall be sized to provide minimum clear opening of 37 by 30 inches. Cover and curb shall be insulated with 1 inch thick rigid insulation covered and protected by galvanized steel liner not less than 26 gauge. The curb shall be equipped with an integral metal cap flashing of the same gauge and metal as the curb, full welded and ground at corners for weathertightness. Hatches shall be completely assembled with heavy hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles on insideoutside and neoprene draft seal. Fasteners shall be provided for padlocking on the inside. The cover shall be equipped with an automatic hold-open arm complete with handle to permit one hand release.

2.16 SAFETY NOSING

Safety nosings shall be of cast aluminum with abrasive surface. Nosing shall be 3 inches wide and terminating at not more than 6 inches from the ends of treads, except nosing for metal pan cement-filled treads shall extend the full length of the tread. Safety nosings shall be provided with

anchors not less than 3/4 inch long. Integrally cast mushroom anchors are not acceptable.

2.17 STEEL STAIRS

Steel stairs shall be complete with structural or formed channel stringers, metal pan cement-filled treads with metal risers, landings, columns, handrails, and necessary bolts and other fastenings as indicated. Structural steel shall conform to \-ASTM A 36-\. Stairs and accessories shall be galvanized. Risers on stairs with metal pan treads shall be deformed to form a sanitary cove to retain the tread concrete. Concrete in stair treads shall be broom finish. [AM#1] Interior stairs shall have quarry tile in concrete; see SECTION 09000; BUILDING COLOR AND FINISH SCHEDULE

2.18 TRENCH COVERS, FRAMES, AND LINERS

Trench frames and anchors shall be all welded steel construction designed to match cover. Covers shall be secured to frameTrench liners shall be cast iron with integral frame for cover.

[AM#1]
2.19 MECHANICAL YARD SCREEN

Mechanical yard screens shall be galvanized, all welded construction as shown on the drawings. All welds shall be ground smooth.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 REMOVABLE ACCESS PANELS

A removable access panel not less than 12 by 12 inches shall be installed directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

3.3 INSTALLATION OF EXHAUST VENTS

Frames of exhaust vents shall be instlled flush with the exterior of the wall surface. Install vents in locations shown on drawings.

3.4 PIPE GUARDS

Pipe guards shall be set vertically in concrete piers. Piers shall be constructed of, and the hollow cores of the pipe filled with, concrete specified in SECTION \=03300=\ CAST-IN-PLACE STRUCTURAL CONCRETE, having a compressive strength of 3000 psi.

[AM#1]
3.5 INSTALLATION OF DRAIN BOOTS

Drain boots shall be secured to building through integral lips with appropriate fasteners.

3.6 INSTALLATION OF STEEL HANDRAILS

Installation shall be in pipe sleeves embedded in concrete and filled with molten lead or sulphur with anchorage covered with standard pipe collar pinned to post. Rail ends shall be secured by steel pipe flanges as described above.

3.7 ERECTION OF GUY CABLES

Guy cables shall be erected as indicated. Anchor rods shall be cast in concrete located and reinforced as shown.

3.8 RECESSED FLOOR MATS

Contractor shall verify field measurements prior to releasing materials for fabrication by the manufacturer. A mat frame shall be used to ensure recess accuracy in size, shape and depth. Drain pit shall be formed by blocking out concrete when frames are installed. Pit shall be dampproofed after concrete has set. Frames shall be assembled onsite and installed so that upper edge will be level with finished floor surface. A cement base shall be screeded inside the mat recess frame area using the edge provided by the frame as a guide. The frame shall be anchored into the cement with anchor pins a minimum of 24 inches on centers.

3.9 INSTALLATION OF SAFETY NOSINGS

Nosing shall be completely embedded in concrete before the initial set of the concrete occurs and shall finish flush with the top of the concrete surface.

3.10 METAL GRATES AND FRAMES

Metal grates and frames shall be secured by means of angle clips and expansion bolts. Continuous door stops shall be welded to the frame or tap screwed with countersunk screws at no more than 18 inch centers, assuring in either case full contact with the frame. Any necessary reinforcements shall be made and the frames shall be drilled and tapped as required for hardware.

[AM#1]
3.11 MECHANICAL YARD SCREEN

Mechanical yard screen shall be installed with tube steel posts as detailed over smaller tube embedded to within 6-inches of the bottom of the foundation, then plug welded in a plumb position. Top corners to be bolted to masonry wall with use of clip angles.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 06100

ROUGH CARPENTRY

09/96

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN FOREST AND PAPER ASSOCIATION (AFPA)

\-AFPA-T901-\	(1991; Supple 1993; Addenda Apr 95) National Design Specification for Wood Construction
\-AFPA T11-WCD1-\	(1988) Manual for Wood Frame Construction

APA-THE ENGINEERED WOOD ASSOCIATION (APA)

\-APA E445-\	(1991; Rev Jan 1996) Performance Standards and Policies for Structural-Use Panels

[AM#1]_____

[AM#1]_____

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 307-\	(1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
\-ASTM C 79-\	(1994) Gypsum Sheathing Board
\-ASTM C 518-\	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Heat Flow Meter Apparatus
\-ASTM C 553-\	(1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
\-ASTM C 578-\	(1995) Rigid, Cellular Polystyrene Thermal Insulation
\-ASTM C 591-\	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
\-ASTM C 612-\	(1993) Mineral Fiber Block and Board Thermal Insulation

\-ASTM C 665-\	(1994) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
\-ASTM C 1013-\	(1994) Faced Rigid Cellular Polyisocyanurate Roof Insulation
\-ASTM C 1136-\	(1992) Flexible, Low Permeance Vapor Retarders for Thermal Insulation
\-ASTM C 1289-\	(1995) Faced Rigid Cellular
\-ASTM E 96-\	(1995) Water Vapor Transmission of Materials
\-ASTM E 154-\	(1988; R 1993) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
\-ASTM F 547-\	(1977; R 1990) Definitions of Terms Relating to Nails for Use with Wood and Wood-Base Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

\-AWPA C2-\	(1995) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
\-AWPA C9-\	(1995) Plywood - Preservative Treatment by Pressure Processes
\-AWPA M4-\	(1995) Standard for the Care of Preservative-Treated Wood Products
\-AWPA P5-\	(1996) Standards for Waterborne Preservatives

CALIFORNIA REDWOOD ASSOCIATION (CRA)

\-CRA-01-\	(1995) Standard Specifications for Grades of California Redwood Lumber

DEPARTMENT OF COMMERCE (DOC)

\-DOC PS 1-\	(1996) Voluntary Product Standard - Construction and Industrial Plywood
\-DOC PS 2-\	(1992) Performance Standards for Wood-Based Structural-Use Panels

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

\-FM P7825c-\	(1997) Approval Guide Building Materials

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

\-NHLA-01-\	(1994) Rules for the Measurement & Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

\-NELMA-01-\	(1993) Standard Grading Rules for Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

\-SCMA-01-\	(1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

\-SPIB-1001-\	(1994) Standard Grading Rules for Southern Pine Lumber

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

\-WCLIB Std 17-\	(1993) Supples III (A), V (A), & VI (A)) Grading Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

\-WWPA-01-\	(1995; Supple Nos. 1, 2, and 3) Western Lumber Grading Rules 95

1.2 SUBMITTALS

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

SD-04 Drawings\

Nailers and Nailing Strips\; *FIO*\.

Drawings of field erection details, including materials and methods of fastening nailers in conformance with Factory Mutual wind uplift rated systems specified in other Sections of these specifications.

SD-13 Certificates\

Grading and Marking\; *FIO*\.

Manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked meet the specified requirements. Certificate of Inspection for grade marked material by an American Lumber Standards Committee (ALSC) recognized inspection agency prior to shipment.

Insulation\; *FIO*\.

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

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity. Laminated timber shall be handled and stored in accordance with \-AITC 111-\ or \-APA EWS R540-\.

PART 2 PRODUCTS

2.1 LUMBER AND SHEATHING

2.1.1 *Grading and Marking*\

2.1.1.1 Lumber Products

Lumber shall bear an authorized gradestamp or grademark recongnized by ALSC, or an ALSC recognized certification stamp, mark, or hammerbrand. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

2.1.1.2 Plywood and other Sheathing Products

Materials shall bear the grademark or other identifying marks indicating grades of material and rules or standards under which produced, including requirements for qualifications and authority of the inspection organization. Except for plywood , bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

2.1.2 Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Unless otherwise specified, sizes indicated are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Treatment

Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with \-AWPA M4-\. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil. Except as specified for all-heart material of the previously mentioned species, the following items shall be treated:

a. Wood members in contact with or within \~18 inches~\ of soil.

b. Wood members in contact with water.

c. Wood members exposed to the weather including those used in roofing systems or as nailing strips.

d. Wood members set into concrete regardless of location, including flush-with-deck wood nailers for roofs.

e. Wood members in contact with concrete that is in contact with soil or water or that is exposed to weather.

[AM#1]
f. All other blocking not covered above.

2.1.3.1 Plywood

Plywood shall be treated in accordance with \-AWPA C9-\ with waterborne preservatives listed in \-AWPA P5-\ to a retention level as follows:

a. \~0.25 pcf~\ intended for above ground use.

b. \~0.40 pcf~\ intended for ground contact and fresh water use.

2.1.4 Moisture Content

At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

a. Treated and Untreated Lumber Except Roof Planking:

\~4 inches~\ or less, nominal thickness, 19 percent maximum. \~5 inches~\ or more, nominal thickness, 23 percent maximum in a \~3 inch~\ perimeter of the timber cross-section.

b. Roof Planking: 15 percent maximum.

c. Materials Other Than Lumber: In accordance with standard under which product is produced.

2.1.5 Sheathing

Sheathing shall be gypsum board, plywood, or wood for wall sheathing.

2.1.5.1 Gypsum Board

Gypsum board shall conform to \-ASTM C 79-\, \~[AM#1] 5/8 inch thick,~\ \~4 feet~\ wide with straight edges for supports \~16 inches~\ on center without corner bracing of framing or for supports \~24 inches~\ on center with corner bracing of framing; \~2 feet wide~\ with V-tongue and groove edges for supports \~16 or 24 inches~\ on center with corner bracing of framing.

2.1.5.2 Plywood

Plywood shall conform to \-DOC PS 1-\, \-APA E445-\ or \-DOC PS 2-\, Grade C-D with exterior glue. Sheathing for roof and walls without corner bracing of framing shall have a span rating of 16/0 or greater for supports \~16 inches~\ on center and a span rating of 24/0 or greater for supports \~24 inches~\ on center.

2.1.5.3 Wood

Species and grade shall be in accordance with TABLE I at the end of this section. Wall sheathing shall be \~1 inch~\ thick for supports \~16 or 24

inches~\ on center without corner bracing of framing provided sheathing is applied diagonally.

2.1.6 Miscellaneous Wood Members

2.1.6.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

\~

Member	Size (inch)
Bridging	1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12.
Corner bracing	1 x 4.
Furring	1 x [2] [3].
Nailing strips	1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock.~\

2.1.6.2 Blocking

Blocking shall be standard or number 2 grade, [AM#1] <u>treated</u>.

2.2 ACCESSORIES AND NAILS

Markings shall identify both the strength grade and the manufacturer. Accessories and nails shall conform to the following:

2.2.1 Anchor Bolts

\-ASTM A 307-\, size as indicated, complete with nuts and washers.

2.2.2 Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws

Type, size, and finish best suited for intended use. Finish options include zinc compounds, cadmium, and aluminum paint impregnated finishes.

2.2.3 Expansion Shields

Type and size best suited for intended use.

2.2.4 Nails and Staples

\-ASTM F 547-\, size and type best suited for purpose; staples shall be as recommended by the manufacturer of the materials to be joined. For sheathing , length of nails shall be sufficient to extend \^25 mm^\ \~1 inch~\ into supports. In general, 8-penny or larger nails shall be used for nailing through \^25 mm^\ \~1 inch~\ thick lumber and for toe nailing

\^50 mm^\ \~2 inch~\ thick lumber; 16-penny or larger nails shall be used for nailing through \^50 mm^\ \~2 inch~\ thick lumber. Nails used with treated lumber and sheathing shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in \-AFPA T11-WCD1-\. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in \-AFPA-T901-\. Reasonable judgement backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

2.3 *INSULATION*

Thermal resistance of insulation shall be not less than the R-values shown. R-values shall be determined at \~75 degrees F~\ in accordance with \-ASTM C 518-\. Insulation shall contain the highest practicable percentage of recovered material which has been recovered or diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

2.3.1 Batt or Blanket

2.3.1.1 Acoustical Batt or Blanket Insulation

Mineral fiber batt shall conform to \-ASTM C 665-\, Type I unfaced insulation

2.3.1.2 Mineral Fiber Blanket

Mineral fiber blanket shall conform to \-ASTM C 553-\, Type I, Class 6. Blankets shall be sized to suit construction conditions, resilient type for use below and above ambient temperature to \~350 degrees F.~\ Blankets shall have a factory applied vapor-barrrier facing on one side with \~2 inch~\ nailing tabs on both edges. Vapor barriers shall be fire retardant, high vapor transmission, and aluminum foil laminated to crepe paper type conforming to \-ASTM C 1136-\, Type II. Nominal density shall be \~0.75 pcf.~\

2.3.2 Sill Sealer

Mineral wool, \~1 inch~\ thick and compressible to \^0.8 mm,^\ \~1/32 inch,~\ width of sill, designed to perform as an air, dirt, and insect seal in conformance with \-ASTM C 665-\, Type I.

2.3.3 Rigid Insulation

2.3.3.1 Polystyrene Board

Polystyrene board shall be extruded and conform to \-ASTM C 578-\, Type IV.

2.3.3.2 Polyurethane or Polyisocyanurate Board

Polyurethane or polyisocyanurate board shall conform to \-ASTM C 1013-\ (having a minimum recovered material content of 9 percent by weight of core material in the polyurethane or polyisocyanurate portion). Unfaced preformed polyurethane shall conform to \-ASTM C 591-\. Faced polyisocyanurate shall conform to \-ASTM C 1289-\.

2.3.3.3 Glass Fiber or Insulation Board

Glass fiber or insulation board shall conform to \-ASTM C 612-\, Type 1A with a minimum recovered material content of 6 percent by weight of glass fiber core material.

2.4 VAPOR RETARDER

Vapor retarder shall be polyethylene sheeting conforming to \-ASTM E 154-\ or other equivalent material. Vapor retarder shall have a maximum vapor permeance rating of \^29 ng per Pa per second per square meter (0.5 perms)^\ \~0.5 perms~\ as determined in accordance with \-ASTM E 96-\, unless otherwise specified.

PART 3 EXECUTION

3.1 INSTALLATION OF FRAMING

3.1.1 General

Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. Members shall be framed for passage of ducts. Members shall be cut, notched, or bored in accordance with applicable requirements of \-AFPA-T901-\ for the passage of pipes, wires, or conduits. Rafters, purlins, and joists shall be set with crown edge up. Framing shall be kept at least \ \~2 inches~\ away from chimneys and \~4 inches~\ away from fireplace backwalls. When joists, beams, and girders are placed on masonry or concrete, a wood base plate shall be positioned and leveled with grout. The joist, beam, or girder shall then be placed on the plate. When joists, beams, and girders are set into masonry or concrete, a pocket shall be formed into the wall. The joist, beam, or girder shall then be placed into the pocket and leveled with a steel shim.

3.1.2 Blocking

Blocking shall be provided as necessary for application of toilet accessories, ADA grab bars, and wood trim items as specified, and other materials or building items as required. Blockiung shall be cut to fit snugly between framing members and rigidly nailed thereto,

3.1.3 Furring strips

Furring strips shall be privided at the location shown. Unless otherwise shown, furring shall be installed at 16 inches on center, run in lengths as long as practicable, butt-jointed and rigidly secured in place.

3.2 INSTALLATION OF SHEATHING

3.2.1 Gypsum Board

Sheathing shall be applied with edges in light contact at joints and nailed in accordance with the manufacturer's approved instructions. Sheets \~2 feet~\ wide shall be applied horizontally with tongued edge up, with vertical joints over supports, and with vertical joints staggered. Sheets \~4 feet~\ wide shall be applied vertically, extended over top and bottom plates, and with all vertical and horizontal joints over supports.

3.2.2 Plywood

Sheathing shall be applied with edges \~1/8 inch~\ apart at side and end joints, and nailed at supported edges at \~6 inches~\ on center and at intermediate supports \~12 inches~\ on center unless otherwise shown. Nailing of edges shall be \~3/8 inch~\ from the edges.

3.2.3 Wood

Sheathing end joints shall be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board shall bear on at least three supports. Boards shall be nailed at each support using two nails for boards \~6 inches~\ and less in width and three nails for boards more than \~6 inches~\ in width.

3.2.4 *Nailers and Nailing Strips*\

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Nailers used in conjunction with roof deck installation shall be installed flush with the roof deck system. Stacked nailers shall be assembled with spikes or nails spaced not more than \~18 inches~\ on center and staggered. Beginning and ending nails shall not be more than \~6 inches~\ for nailer end. Ends of stacked nailers shall be offset approximately \~12 inches~\ in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members when necessary, and rigidly secured in place. Nailers and nailer installation for Factory Mutual wind uplift rated roof systems specified in other Sections of these specifications shall conform to \-FM P7825c-\.

[AM#1]_____

3.3 INSTALLATION OF INSULATION

Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the \^thermal resistance^\ \~R-values~\ shown. For acoustical insulation the installed thickness shall be as shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

3.4 INSTALLATION OF VAPOR RETARDER

[AM#1]
Vapor retarder shall be applied to provide a continuous barrier at the exterior walls of Areas B, C, D, E, and F and especially at window and door frames, and at all penetrations such as electrical outlets and switches, plumbing connections, and utility service penetrations. Joints in the vapor retarder shall be lapped and sealed according to the manufacturer's recommendations.

TABLE I. SPECIES AND GRADE

Subflooring, Roof Sheathing, Wall Sheathing, Furring

Grading Rules	Species	Const Standard	No. 2 Comm	No. 2 Board Comm	No. 3 Comm
\-NHLA-01-\					
	Cypress			X	
\-NELMA-01-\					
	Northern White Cedar				X
	Eastern White Pine	X			
	Northern Pine	X			
	Balsam Fir				X
	Eastern Hemlock-Tamarack				X
\-CRA-01-\					
	Redwood		X		
\-SCMA-01-\					
	Cypress			X	
\-SPIB-1001-\					
	Southern Pine		X		
\-WCLIB Std 17-\					
	Douglas Fir-Larch	X			
	Hem-Fir	X			
	Sitka Spruce	X			
	Mountain Hemlock	X			
	Western Cedar	X			
\-WWPA-01-\					
	Douglas Fir-Larch	X			
	Hem-Fir	X			
	Idaho White Pine	X			
	Lodgepole Pine			X	
	Ponderosa Pine			X	
	Sugar Pine			X	
	Englemann Spruce			X	
	Douglas Fir South			X	
	Mountain Hemlock			X	
	Subalpine Fir			X	
	Western Cedar			X	

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

TABLE II. SPECIES AND GRADE

Wood Bumper

Grading Rules	Species	No. 1	No. 2
\-NHLA-01-\	Red Oak	X	
\-NELMA-01-\			
	Northern Pine		X
	Eastern Hemlock-Tamarack		X
\-SPIB-1001-\			
	Southern Pine	X	
\-WCLIB Std 17-\			
	Douglas Fir-Larch		X
	Hem-Fir		X
\-WWPA-01-\			
	Douglas Fir-Larch		X
	Hem-Fir		X
	Douglas Fir-South		X

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 06200

FINISH CARPENTRY

09/96

PART 1 GENERAL

1.1 REFERENCES

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

APA-THE ENGINEERED WOOD ASSOCIATION (APA)

\-APA E445-\	(1991; Rev May 1991) Performance Standards and Policies for Structural-Use Panels

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM F 547-\	(1977; R 1990) Definitions of Terms Relating to Nails for Use with Wood and Wood-Base Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

\-AWPA M4-\	(1995) Standard for the Care of Preservative-Treated Wood Products
\-AWPA P5-\	(1996) Standards for Waterborne Preservatives

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

\-AWI-02-\	(1994) Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program

CALIFORNIA REDWOOD ASSOCIATION (CRA)

\-CRA-01-\	(1995) Standard Specifications for Grades of California Redwood Lumber

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

\-NELMA-01-\	(1993) Standard Grading Rules for Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURER'S ASSOCIATION (SCMA)

\-SCMA-01-\	(1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

\-SPIB-1001-\ (1994) Standard Grading Rules for Southern Pine Lumber

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

\-WCLIB Std 17-\ (1993; Supples III (A), V (A), & VI (A)) Grading Rules For West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

\-WWPA-01-\ (1995; Supple Nos. 1, 2, and 3) Western Lumber Grading Rules 95

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)

\-WMMPA WM 6-\ (1987) Industry Standard for Non-Pressure Treating of Wood Millwork

1.2 SUBMITTALS

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

SD-01 Data\

Wood Items, Siding, and Trim\; *FIO*\.

Manufacturer's printed data indicating the usage of engineered or recycled wood products, and environmentally safe preservatives.

SD-04 Drawings\

Finish Carpentry\; *FIO*\.

Drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

SD-14 Samples\
[AM#1]
<u>*Moldings*\; *FIO*\</u>.

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 *WOOD ITEMS, SIDING, AND TRIM*\

The Contractor shall furnish products which optimize design by reducing the amount of wood used (engineered wood), or recycled wood products, and preservatives without arsenic or chromium when the products and methods are competitive in price or directed by the Contracting Officer.

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, structural-use panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Moldings
[AM#1]
Molding shall be premium grade red oak and shall conform to WMMPA WM 6, N Grade for natural, clear or satin finish; P Grade for paint finish. Pattern of molding shall be as indicated on Drawings. Finish as indicated in Specifications Section 09000; BUILDING COLOR AND FINISH SCHEDULE.

2.1.2.1 Utility Shelving
[AM#1]
Utility shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under \-WWPA-01-\, \~1 inch~\ thick; or plywood, interior type, Grade A-B, \~3/4 inch~\ thick, any species group.

2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to \-ASTM F 547-\. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend \^\ \~1-1/2 inches~\ into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Shelving

Shelving shall be anchored to supporting construction. Unless otherwise indicated, shelves shall be supported by wall-supported brackets not more than \~24 inches~\ on center or as required to limit deflection to \~1/4 inch~\ between supports with a load of \~35 lb per lineal foot.~\ Adjustable shelf hardware shall be steel standards, channel shaped, with \~1 inch~\ adjustment slots and brackets designed for attachment to standards.

[AM#1]

3.1.2 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machined sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at extrernal corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Windoew and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal, setting and stopping of screws shall be of the same quality as required where nails are used.

TABLE I. SPECIES AND GRADE TABLE

Grading Rules	Species	Choice	Clear	C Select	C & Better
\-NELMA-01-\	Eastern Cedar		X		
	Eastern Hemlock		X		
	Tamarack				X
	Eastern W. Pine				X
	Northern Pine				X
	Eastern Spruce			X	
	Balsam Fir		X		
\-CRA-01-\	Redwood		X		
\-SCMA-01-\	Cypress			X	
\-SPIB-1001-\	Southern Pine				X
\-WCLIB Std 17-\	Douglas Fir				X
	Larch				X
	Hemlock Fir				X
	Mountain Hemlock				X
	Sitka Spruce				X
\-WWPA-01-\	Douglas Fir			X	
	Larch				X
	Hemlock Fir		X		
	Mountain Hemlock				X
	Western Larch		X		
	Idaho White Pine	X			
	Lodgepole Pine		X		
	Ponderosa Pine		X		
	Sugar Pine		X		
	Englemann Spruce		X		
	Douglas Fir South		X		
	Subalpine Fir		X		

NOTE 1: Western Cedar under \-WCLIB Std 17-\ shall be Grade B; and under \-WWPA-01-\, Western Cedar shall be Grade B bevel for siding and Grade A for trim.

NOTE 2: Except as specified in NOTE 3 below, siding and exterior trim shall be any of the species listed above. Interior trim shall be any one of the species listed above and the highest grade of the species for stain or natural finish and one grade below highest grade of species for paint finish.

NOTE 3: Southern Yellow Pine, Douglas Fir, Larch, Western Larch, and Tamarack shall not be used where painting is required and may be used on exterior work only when approved and stained with a preservative type stain.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 07112

BITUMINOUS WATERPROOFING

12/93

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 208-\	(1995) Cellulosic Fiber Insulating Board
\-ASTM D 41-\	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
\-ASTM D 173-\	(1994) Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing
\-ASTM D 449-\	(1989; R 1994) Asphalt Used in Dampproofing and Waterproofing
\-ASTM D 1327-\	(1994) Bitumen-Saturated Woven Burlap Fabrics Used in Roofing and Waterproofing
\-ASTM D 1668-\	(1994) Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
\-ASTM D 4586-\	(1993) Asphalt Roof Cement, Asbestos Free

1.2 SUBMITTALS

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

SD-01 Data\

Reinforcing Fabric\; *GA*\.

Protection Board\; *GA*\.

Manufacturer's data including technical information which indicates full compliance with this section.

SD-06 Instructions\

Application\; *FIO*\.

Manufacturer's installation instructions, before delivery of materials to the site. Instructions shall specify acceptable range of asphalt application temperatures and the maximum temperature for holding asphalt in a heated condition.

SD-13 Certificates\

Materials\; *FIO*\.

Certificates from manufacturer attesting that asphalt manufactured and shipped to jobsite meets the specified requirements.

1.3 QUALIFICATIONS

Work shall be performed by skilled laborers thoroughly experienced in the type of bituminous waterproofing work specified to meet the requirements of the contract.

1.4 DELIVERY, STORAGE AND HANDLING

Waterproofing materials shall be delivered to the project site in the original sealed containers bearing the name of the manufacturer, contents and brand name. Asphalt shall be protected from freezing in a weathertight enclosure. Reinforcement fabrics shall be protected from moisture damage and moisture absorption in a weathertight enclosure or shall be stored off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup and therefore shall not be used to cover waterproofing materials. Damaged or deteriorated materials shall be removed from project site.

PART 2 - PRODUCTS

2.1 ASPHALT WATERPROOFING

2.1.1 Primer

Primer for hot-applied asphalt waterproofing shall conform to \-ASTM D 41-\, asbestos-free, non-fibrated, manufactured with highly ductile soft asphalts and selected hydrocarbons.

2.1.2 Below-Grade Hot-Applied Asphalt

Hot-applied asphalt for below-grade applications shall conform to \-ASTM D 449-\, Type I, asbestos-free, manufactured from crude petroleum, suitable for use with membrane waterproofing systems.

2.1.3 Reinforcement Fabrics

2.1.3.1 Cotton Fabrics

Cotton fabrics shall be woven entirely of cotton conforming with \-ASTM D 173-\, thoroughly and uniformly saturated with asphalt.

2.1.3.2 Woven Burlap Fabrics

Woven burlap fabrics shall be composed of 100 percent jute fiber and two cotton threads at each selvage conforming with \-ASTM D 1327-\, thoroughly and uniformly saturated with asphalt. The fabric mesh shall not be completely closed or sealed by the process of saturation. Sufficient porosity shall be maintained to allow successive moppings of the plying asphalt to seep through. The surface shall not be coated or covered with talc or any other substances that will interfere with the adhesion between fabric and plying asphalt. The fabric surface shall be uniformly smooth and free of irregularities, folds and knots. The finished woven burlap fabrics shall be free of ragged edges, untrue edges, breaks or cracks, and other visible external defects.

2.1.3.3 Glass Fabrics

Glass fabrics shall conform to \-ASTM D 1668-\ Type I, asphalt-treated woven glass waterproofing fabrics coated with asphalt.

2.1.4 Flashing Cement

Flashing cement shall conform to \-ASTM D 4586-\, Type I, trowel grade, asbestos free, manufactured from asphalts characterized as adhesive, healing and ductile.

2.2 INSULATION BOARDS

Insulation boards shall conform to \-ASTM C 208-\ cellulosic fiber boards, construction grade, \~1/2 inch~\ thick, fibrous-felted homogeneous panel. Insulation boards shall be manufactured from ligno-cellulosic fibers (wood or cane) by a felting or molding process, asphalt-saturated or coated, with a density of 10 to 31 lbs. per square foot. Surfaces of insulation boards shall be free of cracks, lumps, excessive departure from planeness, or other defects that adversely affect performance.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

Surfaces scheduled for bituminous waterproofing shall be prepared in accordance with waterproofing manufacturer's recommendations. Surface preparation shall be approved prior to waterproofing application.

3.1.1 Protection of Surrounding Areas

Before starting the waterproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of

asphalt onto other work. Drains and conductors shall be protected from clogging with asphalt.

3.1.2 Masonry Surfaces

Surfaces shall be free of oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Mortar joints shall be flush and free of extraneous mortar and chipped or broken masonry.

3.1.3 Concrete Surfaces

Surfaces shall be properly cured, free of form release agents, oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Form ties shall be cut flush with surface. Sharp protrusions and form match lines shall be removed. Holes, voids, spalled areas and cracks which can damage waterproofing materials shall be repaired. Rough surfaces shall be parged with a well-adhering coat of cement mortar.

3.1.4 Metal Surfaces

Surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.

3.2 HOT-APPLIED ASPHALT WATERPROOFING

Asphalt waterproofing shall be applied when the ambient temperature is \^4 degrees C^\ \~40 degrees F~\ or above. Heating kettles and tanks shall be provided with automatic thermostatic control capable of maintaining asphalt temperature. Controls shall be calibrated and maintained in working order for duration of work. At time of application, asphalt shall not be heated above the equiviscous temperature (EVT) recommended by manufacturer. Immediately before use, temperature shall be measured with a portable thermometer at the point of application. EVT and flashpoint temperatures of asphalt in kettle shall be conspicuously posted on kettle. Asphalt with a temperature not conforming to the manufacturer's recommendations shall be returned to the kettle. Asphalt overheated by more than \^10 degrees C^\ \~50 degrees F~\ for more than 1 hour shall be removed from site.

3.2.1 Below-Grade Wall Waterproofing

Waterproofing for foundation walls shall consist of a 2-ply hot-applied asphalt membrane system. Fabrics shall be

installed using the "shingle" method. Joints shall be caulked prior to primer applications. Primer shall be applied at a rate of \~1/2 gallon per 100 square feet.~\ Fabrics shall be overlapped at ends and staggered a minimum \~19 inch~\ for 2-ply system. End-to-end taping is not acceptable. Each fabric shall be firmly embedded into a solid uniform coating of hot asphalt at a rate of 20 pounds per 100 square feet by pressing with broom. Fabrics shall not touch fabrics. Hot asphalt shall penetrate each fabric to provide the required adhesion. Asphalt between fabrics shall not be excessive to prevent slippage. Waterproofing system consisting of two or more fabrics shall be provided with fabric reinforcement at corners, angles, over construction joints, and in locations where waterproofing fabrics are subject to unusual stress.

3.2.2 Floor Waterproofing

Primer shall be applied at a rate of 1/2 gallon per 100 square feet. Primer shall not be left in puddles. Primer shall be dry to the touch before application of asphalt. Where slab abuts walls, first reinforcing fabric shall extend 6 inches minimum on slab and 8 inches on wall. At vertical corners, first fabric shall extend minimum 5 inches from corner on each side. Second fabric shall lap the first fabric 2 inches minimum. At floor drains, and elsewhere as indicated, the fabric shall extend into a clamping device, set in a heavy coating of flashing cement, and securely clamped.

3.3 \+FLOOD TESTING+\

Prior to concealment, waterproofed floors over occupied spaces shall be tested for watertightness. Drains shall be plugged and floors shall be submerged with 3 inches of clean water. Water shall be permitted to stand for a minimum of 24 hours. If leaks occur, water shall be drained and repairs made. Upon completion of repairs, floors shall be flooded with 3 inches of clean water and flood testing shall be repeated for minimum of 24 hours from the time each leak is repaired. Waterproofing system shall be completely watertight, and shall be approved in writing before covering up with other materials. Additional coats of asphalt are not an acceptable method for repairing leaks.

3.4 CLEAN-UP

Surfaces of other work which are stained with waterproofing materials shall be cleaned with a cleaner recommended by waterproofing manufacturer.

3.5 PROTECTION OF COMPLETED WORK

3.5.1 Floor Waterproofing

The completed waterproofing work shall be protected from damage during and after construction. Protective covering shall be placed immediately before proceeding with the work which will conceal the waterproofing.

3.5.2 Wall Waterproofing

Waterproofing against which backfill is to be placed shall be protected with a single layer of insulation board. Insulation boards shall be pressed into the final mopping while the asphalt is still hot, with edges of boards placed into moderate contact and joints staggered. For two-layer installation, joints in second layer shall be staggered over joints in first layer. Where surfaced insulation board is used, the surfaced side shall face outward. Boards shall be carefully and neatly fitted around projections, and shall cover the entire surface of the waterproofing materials. Waterproofing system not covered with protection boards shall be protected to prevent damage from subsequent building operations. Installed boards shall not remain exposed at the end of a work day.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 07160

BITUMINOUS DAMPPROOFING

12/93

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM D 41-\	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
\-ASTM D 1187-\	(1995) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
\-ASTM D 1227-\	(1987) Emulsified Asphalt Used as a Protective Coating for Roofing
\-ASTM D 4479-\	(1993) Asphalt Roof Coatings - Asbestos Free

1.2 SUBMITTALS

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

SD-13 Certificates\

Materials\; *FIO*\.

Certificates attesting that the materials meet the requirements specified.

1.3 QUALIFICATIONS

Work shall be performed by skilled laborers thoroughly experienced in the type of bituminous dampproofing work specified to meet the requirements of the contract.

1.4 DELIVERY, STORAGE AND HANDLING

Dampproofing materials shall be delivered to the project site in the original sealed containers bearing the name of manufacturer, contents and brand name, and stored in a weathertight enclosure to prevent moisture damage and absorption. Dampproofing materials shall be protected from freezing. Asphalt shall be stored off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets

cause condensation buildup and therefore shall not be used to cover dampproofing materials. Care shall be taken during storage to avoid separation or settlement of the emulsion components. Damaged or deteriorated materials shall be removed from the project site.

PART 2 - PRODUCTS

2.1 EMULSION-BASED ASPHALT DAMPPROOFING

2.1.1 Fibrated Emulsion-Based Asphalt

Fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to \-ASTM D 1227-\ Type IV, asbestos-free, manufactured of refined asphalt, emulsifiers and selected clay, fibrated with mineral fibers. For spray or brush application, emulsion shall contain a minimum of 59 percent solids by weight, 56 percent solids by volume. For trowel application, emulsion shall contain a minimum of 58 percent solids by weight, 55 percent solids by volume.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

Surfaces scheduled for bituminous dampproofing shall be prepared in accordance with dampproofing manufacturer's recommendations. Surface preparation shall be approved prior to dampproofing application.

3.1.1 Protection of Surrounding Areas

Before starting the dampproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of asphalt onto other work. Drains and conductors shall be protected from clogging with asphalt.

3.1.2 Masonry Surfaces

Surfaces shall be free of oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Mortar joints shall be flush and free of extraneous mortar and chipped or broken masonry.

3.1.3 Concrete Surfaces

Surfaces shall be properly cured, free of form release agents, oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Form ties shall be cut flush with surface. Sharp protrusions and form match lines shall be removed. Holes, voids, spalled areas and cracks which can damage the dampproofing materials and impair performance shall be repaired. Rough surfaces shall be parged with a well-adhering coat of cement mortar.

3.1.4 Metal Surfaces

Metal surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.

3.2 APPLICATION OF BITUMINOUS DAMPPROOFING

3.2.1 Emulsion-Based Asphalt

Emulsion-based asphalt dampproofing work shall not be performed in temperatures below .40 degrees F. Emulsions shall have a smooth and uniform consistency at time of application. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film of not less than12 mils thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

a. Primer: 1/2 gallon per 100 square feet, cold-applied.

b. Fibrated Dampproofing: 2 gallons per 100 square feet, cold-applied with spray, brush or trowel.

[AM#1]

3.3 COMPATABILITY

Dampproffing and adhesive to attach the rigid insulation with it shall be compatable.

[AM#1]

3.4 CLEAN-UP

Surfaces of other work which are stained with dampproofing materials shall be cleaned with a cleaner recommended by dampproofing manufacturer.

[AM#1]

3.5 PROTECTION

The completed dampproofing work shall be protected from damage during and after construction.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 07220

ROOF INSULATION

05/96

PART
1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 208-\	(1995) Cellulosic Fiber Insulating Board
\-ASTM C 1289-\	(1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
\-ASTM D 41-\	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
\-ASTM D 226-\	(1994) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
\-ASTM D 312-\	(1995) Asphalt Used in Roofing
\-ASTM D 2178-\	(1989) Asphalt Glass Felt Used in Roofing and Waterproofing
\-ASTM D 4586-\	(1993) Asphalt Roof Cement, Asbestos Free
\-ASTM D 4897-\	(1994) Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

\-FM P7825-\	(1995; Supple 1; Supple II; Supple III) Approval Guide

UNDERWRITERS LABORATORIES (UL)

\-UL-01-\	(1996) Building Materials Directory

1.2 SUBMITTALS

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

SD-06 Instructions\

Application of Insulation\; *FIO*\.

Insulation manufacturer's recommendations for the application and installation of insulation.

SD-08 Statements\

Inspection\; *FIO*\.

The inspection procedure for insulation installation, prior to start of roof insulation work.

SD-13 Certificates\

Insulation\; *FIO*\.

Glass Roofing Felt\; *FIO*\.

Organic Roofing Felt\; *FIO*\.

Certificate attesting that the expanded perlite or polyisocyanurate insulation contains recovered material and showing estimated percent of recovered material. Certificates of compliance for felt materials.

1.3 STORAGE OF MATERIALS

Extruded polystyrene shall be stored in accordance with manufacturer's instructions. Other insulation, base sheet, and felt shall be kept dry at all times, before, during, and after delivery to the site and shall be stored in an enclosed building or in a closed trailer. Wet insulation, wet base sheet or wet felt shall be permanently removed from the site. Felts shall be stacked on end one level high. Felt rolls shall be maintained at a temperature above \~50 degrees F~\ for 24 hours immediately before laying.

1.4 FIRE CLASSIFICATION

Insulation shall have been tested as part of a roof construction assembly of the type used in this project and the construction shall be listed as Fire-Classified in \-UL-01-\ or Class I in \-FM P7825-\

1.5 WIN UPLIFT CLASSIFICATION

Insulation shall be an approved component of a roof covering assembly that is rated Class 1-90 in FM P7825.

PART 2 - PRODUCTS

2.1 CSPE ROOF ASSEMBLY

Insulation for CSPE membrane roofing assembly and all related roof assembly materials shall be as recommended in membrane manufacturer’s printed instructions; facers of the insulation shall be of a type permitting fully adhered method of CSPE membrane attachment. Only CSPE assembly capatible materials shall be used.

2.2 BITUMINOUS MATERIALS

Bituminous materials shall conform to the following requirements:

2.2.1 Asphalt Bitumen

\-ASTM D 312-\, Type III or IV. Asphalt flash point, finished blowing temperature, and equiviscous temperature (EVT) shall be indicated on bills of lading or on individual containers.

2.2.2 Asphalt Cement

\-ASTM D 4586-\, Type I for horizontal surfaces; Type II for vertical surfaces.

2.2.3 Asphalt Primer

\-ASTM D 41-\.

2.3 *INSULATION*\

Insulation shall be a standard product of the manufacturer and shall be factory marked with the manufacturer's name or trade mark, the material specification number, the R-value at \~75 degrees F,~\ and the thickness. Minimum thickness shall be as recommended by the manufacturer. Boards shall be marked individually. The thermal resistance of insulation shall be not less than the R= 21.3 bTUH/SFt-F. Thickness of insulation shall be determined by using a aged R-value of 7.1 Btuh/SFt. The insulation manufacturing process shall not include chlorofluoro carbons (CFC) or formaldehydes. Insulation and fiberboard shall contain the highest practicable percentage of material which has been recovered or diverted from solid waste (e.g., postconsumer waste), but not including material reused in a manufacturing process. Where two materials have comparable price and performance, the one having the higher recovered material content shall be selected. Insulation shall be one, or a combination of the following materials:

2.3.1 Fiberboard

\-ASTM C 208-\ Type II, Grade 1 or 2, roof insulating board with a minimum recovered material content of 80 percent, treated with sizing, wax or bituminous impregnation. Bituminous impregnation shall be limited to 4 percent by weight when used over steel decks.

2.3.2 Polyisocyanurate

\-ASTM C 1289-\, Type I, or \-ASTM C 1289-\ Type II, having minimum recovered material content of 9 percent by weight of the polyisocyanurate portion of the board.

2.4 NAILS AND FASTENERS

Nails and fasteners shall conform to the following requirements:

2.4.1 Fasteners

Fasteners for securiting insulation ti the roof deck shall be an approved component of a roof covering assembly that is rated Class 1-90 in FM P7825 for wind uplift.

2.4.2 Metal Disks

Disks used in conjunction with fasteners for securing insulation to deck shall be an approved component of a roof covering assembly that is rated Class 1-90 in FM P7825 for winf uplift.

2.5 VENTING INORGANIC BASE SHEET

\-ASTM D 4897-\, Type II, Non-perforated, with spot mopping holes where specified.

2.6 GLASS ROOFING FELT

\-ASTM D 2178-\, Type IV.

2.7 ORGANIC ROOFING FELT

\-ASTM D 226-\, Type I.

2.8 WOOD NAILERS

Wood nailers shall conform to Section \=06100=\ ROUGH CARPENTRY including preservative treatment. Edge nailers shall be not less than nominal \~6 inches~\ wide and of thickness to finish flush with the top surface of the insulation. Surface mounted nailers shall be a nominal \~3 inches~\ wide by the full thickness of the insulation.

[AM#1]

2.9 VAPOR RETARDER

The vapor retarder shall be polyethylene film conforming to \-ASTM D 2103-\ 10 mil minimum thickness.

PART 3 - EXECUTION

3.1 COORDINATION REQUIREMENTS

Insulation and roofing membrane shall be finished in one operation up to the line of termination at the end of each day's work. Completed sections shall be waterproofed when more than one day is required to finish the roofing. Phased construction will not be permitted.

3.2 ENVIRONMENTAL CONDITIONS

Air temperature shall be above \~40 degrees F~\ and there shall be no visible ice, frost, or moisture on the roof deck when the insulation and roofing are installed.

3.3 SUBSTRATE PREPARATION

The substrate construction of any bay or section of the building shall be completed before insulation or vapor retarder work is begun thereon. Vents and other items penetrating the roof shall be secured in position and properly prepared for flashing. Prior to application of vapor retarder or insulation, substrate joints shall be covered with a \~4 inch~\ strip of roofing felt, embedded in and coated with asphalt cement. Substrate surface shall be smooth, clean, and dry at time of application.

3.4 HEATING OF ASPHALT

Asphalt shall not be heated higher than \~75 degrees F~\ above the EVT or \~50 degrees F~\ below the flash point, or \~525 degrees F,~\ whichever is lower. EVT and flash point temperatures of asphalt in the kettle shall be conspicuously posted on the kettle. Kettle shall be provided with automatic thermostatic controls and an accurate thermometer. Kettle operators shall be in attendance at all times during heating to ensure that the maximum temperature is not exceeded. Asphalt shall be applied within a range of \~25 degrees F~\ below or above the EVT, or as specified by the manufacturer. Application temperature shall be measured at the mop bucket or mechanical applicator. Asphalt at a temperature below this range shall be returned to the kettle. Flame-heated equipment shall not be placed on the roof.

3.5 INSTALLATION OF WOOD NAILERS

Nailers shall be [AM#1] <u>secured to steel decks and bar joists</u> as indicated. Bolt anchors shall have nuts and washers countersunk, and bolts shall be cut flush with top of nailer. Powder-actuated fasteners, sized and spaced for nailer anchorage equivalent to that specified and indicated, may be used when approved. Surface mounted nailers shall be installed parallel with the roof slope and shall be spaced not over \~4 feet~\ face-to-face, except that where the insulation units are less than \~4 feet~\ in length the nailers shall be spaced to minimize cutting of the insulation. Nailers and nailer installation for Factory Mutual wind uplift rated roof systems

shall conform to the recommendations contained in Factory Mutual Loss Prevention Sheet 1-49.

3.6 *APPLICATION OF INSULATION*\

Insulation shall be laid in two or more layers. Units of insulation shall be laid in courses parallel with the roof slope. End joints shall be staggered. Insulation shall be cut to fit neatly against adjoining surfaces. Joints between insulation boards shall not exceed \~1/4 inch.~\ Joints in successive layers shall be staggered with respect to joints of preceding layer. Where insulation is applied over steel deck, long edge joints shall continuously bear on surfaces of the steel deck. Insulation which can be readily lifted after installation is not considered to be adequately secured. Insulation shall be applied so that all roof insulation applied each day is waterproofed the same day. Phased construction will not be permitted. Application of impermeable faced insulation shall be performed without damage to the facing.

3.6.1 Mechanical Fastening

All layers of insulation shall be mechanically attached to the deck. Area of insulation board per fastener shall be as required by FM P7825 for thye selected FM Class 1-90 rated roof covering assembly. Fastener count shall be increased by 50% in corners and at the perimeter of the roof, as required by FM Loss Prevention Data Sheet 1-28.

3.6.2 Foam Insulation

Polyisocyanurate foam insulations shall be isolated from roof membrane by a separate or composite layer of

3.6.3 Protection Requirements

The insulation shall be kept dry at all times. Insulation boards shall not be kicked into position. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent. Cutoffs shall be 2 layers of bituminous-saturated felt set in plastic bituminous cement. Cutoffs shall be removed when work is resumed. Edges of insulation at open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, shall be protected until permanent roofing and flashing is applied. Storing, walking, wheeling, or

trucking directly on insulation or on roofed surfaces will not be permitted. Smooth, clean board or plank walkways, runways, and platforms shall be used, as necessary to distribute weight to conform to a 65 Pounds/SF \~pounds per square foot~\ live load limit.

[AM#1]

3.6.4 Vapor Retarder

The vapor retarder shall be installed over the structural steel deck on all membrane roofs except for the Central Plant. The vapor retarder shall be installed to form a cpomplete retarder to vapor infiltration. The joints shall be sealed with foil backed tape as recommended by the manufacturer.

3.7 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.

b. Verification of certification, listing or label compliance with \-FM P7825-\.

c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.

d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.

e. Inspection of mechanical fasteners; type, number, length, and spacing.

f. Coordination with other materials, cants, sleepers, and nailing strips.

g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.

h. Installation of cutoffs and proper joining of work on subsequent days.

i. Continuation of complete roofing system installation to cover insulation installed same day.

- - o O o - -

SECTION 07240

EXTERIOR [AM#1]_____ AND FINISH SYSTEM

06/93

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM B 117-\	(1994) Operating Salt Spray (Fog) Testing Apparatus
\-ASTM C 67-\	(1994) Sampling and Testing Brick and Structural Clay Tile
\-ASTM C 473-\	(1995) Physical Testing of Gypsum Board Products and Gypsum Lath
\-ASTM C 578-\	(1992) Rigid, Cellular Polystyrene Thermal Insulation
\-ASTM C 920-\	(1987) Elastomeric Joint Sealants
\-ASTM C 947-\	(1989) Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam With Third-Point Loading)
\-ASTM C 948-\	(1994) Dry and Wet Bulk Density, Water Absorption and Apparent Porosity of Thin Sections of Glass-Fiber-Reinforced Concrete
\-ASTM C 1149-\	(1990) Self-Supported Spray-Applied Cellulosic Thermal or Acoustical Insulation, or Both

\-ASTM D 968-\	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
\-ASTM D 2394-\	(1983; R 1993) Simulated Service Testing of Wood and Wood-Base Finish Flooring
\-ASTM E 72-\	(1980) Conducting Strength Tests of Panels for Building Construction
\-ASTM E 84-\	(1995) Surface Burning Characteristics of Building Materials
\-ASTM E 96-\	(1994) Water Vapor Transmission of Materials
\-ASTM E 136-\	(1994) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
\-ASTM E 330-\	(1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
\-ASTM G 23-\	(1995) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
\-ASTM G 53-\	(1993) Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) For Exposure of Nonmetallic Materials

EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA)

\-EIMA 101.86-\	(1992; Rev May 1994) Resistance of Exterior Insulation and Finish Systems to the Effects of Rapid Deformation (Impact)

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

\-ICBO-102S94-\	(1994) Uniform Building Code Standards: Uniform Building Code, Vol. III

1.2 DESCRIPTION

The exterior finish system EFS shall be a job-fabricated exterior wall covering consisting of weather resistive barrier, base board, base coat, finish coat, and accessories. The system shall be the standard product of a manufacturer regularly engaged in furnishing exterior finish systems and shall be installed by an applicator approved by the system manufacturer. EFS shall be sand finish. Color as specified in section 09000; BUILDING COLOR AND FINISH SCHEDULE.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Test Specimens

Unless otherwise noted, the test specimens shall consist of base coat and finish coat applied in accordance with the manufacturer's printed recommendations to a base board common to the system. These test specimens shall be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

1.3.1.1 Flame Spread

Flame spread test samples consist of base coat, and finish coat, mounted on a non-combustible substrate. When tested in accordance with \-ASTM E 84-\, the samples shall have a flame spread rating of 25 or less.

1.3.1.2 Full Scale Wall Fire Test

Full scale wall fire test specimens shall include the complete system. Test shall be performed in accordance with \-ICBO-102S94-\, Section 17-6. The specimen shall not contribute to significant or horizontal flame spread.

1.3.2 Structural Performance Test

[AM#1]

The system shall have been tested in accordance with \-ASTM E 330-\ to minimum positive and negative pressures of 30 \~psf.~\ Test panels shall be \~4 feet~\ by \ \~4 feet~\ minimum, consisting of the typical system assembly.

1.4 SUBMITTALS

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

SD-06 Instructions\

Exterior Finish System\; *FIO*\.

Two copies of manufacturer's standard printed instructions for installation of the system. Instructions shall include manufacturer's recommended details for corner treatment, jambs, sills, openings, joints and other special applications.

SD-08 Statements\

Manufacturer's Approval and License\; *FIO*\.

Statement from manufacturer attesting that the applicator is approved and licensed to install the system.

SD-09 Reports\

Exterior Finish System\; *FIO*\.

Test Reports indicating that the system complies with the specified performance tests. Tests shall be by an approved, independent testing laboratory.

SD-14 Samples\

Exterior Finish System\; *FIO*\.

Two samples of each exterior finish system. Each sample shall be \^300 mm square,^\ \~one foot square,~\ minimum, and shall be identical to the proposed installation in thickness, color, texture, insulation and workmanship.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in their original unopened packages, clearly marked with the manufacturer's name, brand name, and description of contents. Storage shall be in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Stored materials shall be protected from sunlight, and kept away from excessive heat. Coating

materials which would be damaged by freezing shall be kept at a temperature not less than \ \~40 degrees F.~\

PART 2 - PRODUCTS

2.1 EXTERIOR CEMENT BOARD

[AM#1]

Exterior cement board shall be a non-combustible exterior grade portland cement product. Board shall be \^\ \~4 by 8 feet~\ with a minimum \ \~5/8 inch~\ thickness. Boards shall consist of an aggregated portland cement core faced on both surfaces and wrapped on long edges with an embedded polymer-coated glass fiber mesh. Bonding surface shall have rough texture. Exterior cement board shall comply with the following requirements:

\

Property	Test Method	Requirement
Flexural Strength	\-ASTM C 947-\	750 psi, Min.
Compressive Strength	\-ASTM D 2394-\	1250 psi, Min.
Crack Resistance	\-ASTM E 72-\	No cracking
Non-combustibility	\-ASTM E 136-\	Pass
Flame Spread/Smoke	\-ASTM E 84-\	5/0 max.
Water Absorption	\-ASTM C 948-\	15 percent max.
Fastener Pull Resistance	\-ASTM C 473-\	120 lb min. (wet or dry)

~\

2.2 WEATHER RESISTIVE BARRIER

Weather resistive barrier shall be number 15 asphalt saturated rag felt, 60 minute type D building.

2.3 BASE COAT

Base coat shall be the manufacturer's standard product and shall be compatible with the finish coat.

2.4 MECHANICAL ANCHORS

Mechanical anchors shall be as recommended by the system manufacturer.

[AM#1]

2.5 FINISH COATING

Finish coating shall be manufacturer's standard product, uniform in color and conforming to the following requirements. Specimens for tests shall have been cured for a minimum of 20 days.

TEST	METHOD	RESULTS
Abrasion Resistance	\-ASTM D 968-\	528 quarts of sand- slight- smoothing - no loss of film integrity.
Accelerated weathering Light and water exposure	\-ASTM G 23-\ or \-ASTM G 53-\	2000 hours. No deterioration
Mildew-fungus at 95 resistance	\-ASTM C 1149-\	Expose for 28 days percent RH, 90 degrees F temperature. No growth of mildew or fungus.
Salt spray resistance	\-ASTM B 117-\	Withstand 300 hours - No deleterious effects.
Water Vapor	\-ASTM E 96-\	Not more than 18 grains an hour per square foot.

Absorption-freeze Total (Pre-weighed not more than 8" grams. No checking, in splitting, or stored in air; tested	\-ASTM C 67-\ 4" by 50 Cycles: specimens; 1" insulation, faced cracking. finish with edges and	After 50 cycles - 20 weight gain of hrs. at -9 degrees 6.2 with C; 4-hr. thaw coat cured and water back open.)

2.5 SEALANT

Sealant shall meet requirements of \-ASTM C 920-\, Class 25, and shall be compatible with the finish system. Type, Grade, and Use shall be as recommended by both the sealant manufacturer and the system manufacturer. When required, primer, bond breaker and backstop shall be non-staining, and as recommended by the sealant manufacturer and the system manufacturer.

2.6 ACCESSORIES

Accessories shall conform to the recommendations of the system manufacturer and shall include trim, edging, anchors, sealant and filler rod required for proper installation of the system.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

Surface shall be free of oil, loose materials or protrusions which will interfere with the system installation.

3.2 ENVIRONMENTAL CONDITION

Unless a higher temperature is required by the system manufacturer, the ambient air temperature shall be \~40 degrees F~\ or greater and rising at the time of installation of the system and shall be predicted to remain at \~40 degrees F~\ or greater for at least 24 hours after installation.

3.3 EXTERIOR CEMENT BOARD

Exterior cement board shall be attached over weather resistive barrier to metal studs with self-tapping wafer-head, corrosion resistant screws. Screws and nails for application of the board shall be spaced not more than \~8 inches~\ on each supporting member. Fasteners shall be more closely spaced when required for negative wind load resistance. Edges and ends of

boards shall be butted snugly with vertical joints and joints treated with exterior tpe as recommended by system manufacturer.

3.4 BASE COAT

Base coat shall be mixed in accordance with the manufacturer's instructions and applied to wall and soffit surfaces, trowelling the material in a tight coat and doubling back to provide complete coverage of the panel joints and fasteners. Base coat may be used to level out surface areas when permitted by the manufacturer.

3.5 FINISH COATING

Finish coating shall be applied and leveled in one operation. Final texture shall be obtained by trowels, floats, or by spray application as necessary to achieve the required finish. Finish surfaces shall be plane, with no deviation greater than \~1/4 inch~\ when tested with a \~10 foot~\ straightedge.

3.6 SEALANT

Edges of the exterior insulation and finish system shall be sealed at openings as recommended by the system manufacturer.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 07416

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

07/95

PART
1 - GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

\-AA-01-\	(1993) Aluminum Standards and Data
\-AA SAS-30-\	(1986) Aluminum Construction Manual Series - Section 1 Specifications for Aluminum Structures

AMERICAN IRON AND STEEL INSTITUTE (AISI)

\-AISI SG-673-\	(1986; Addenda 1989) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 463-\	(1994) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
\-ASTM A 653-\	(1994) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
\-ASTM A 792-\	(1993a) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, General Requirements
\-ASTM A 924-\	(1994) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
\-ASTM B 117-\	(1994) Operating Salt Spray (Fog) Testing Apparatus
\-ASTM C 518-\	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
\-ASTM C 1289-\	(1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
\-ASTM D 522-\	(1993a) Mandrel Bend Test of Attached Organic Coatings

\-ASTM D 523-\	(1989; R 1993) Specular Gloss
\-ASTM D 714-\	(1987; R 1994) Evaluating Degree of Blistering of Paints
\-ASTM D 968-\	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
\-ASTM D 1308-\	(1987; R 1993) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
\-ASTM D 1654-\	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
\-ASTM D 2244-\	(1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates
\-ASTM D 2247-\	(1994) Testing Water Resistance of Coatings in 100% Relative Humidity
\-ASTM D 2794-\	(1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
\-ASTM D 3359-\	(1995) Measuring Adhesion by Tape Test
\-ASTM D 4214-\	(1989) Evaluating the Degree of Chalking of Exterior Paint Films
\-ASTM E 84-\	(1994a) Surface Burning Characteristics of Building Materials
\-ASTM E 1592-\	(1994) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
\-ASTM G 23-\	(1995) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

\-ASCE 7-\	(1993) Minimum Design Loads for Buildings and Other Structures

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

\-MBMA-01-\	(1986; Errata; Supple 1990) Low Rise Building Systems Manual

UNDERWRITERS LABORATORIES (UL)

UL 01	(1995 AND 1995 Suplement) Roofing Materials and Systems Directory.
UL 580	(1988, Rev. thru Dec. 1998) Tests for uplift Resistance of Roof assemblies.

1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a manufacturer's standard product which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

1.2.1 Manufacturer

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

1.2.1.1 Manufacturer’s Representative

A representative of the SSMRS manufacturer, who is familiar with the design of the roof system supplied and exoerienced in the erection of roof systems similar in size to the one required under this contract, shall be present at the job site during installation of the SSMRS to assure that the roof system meets the specified requirements. The manufacturer’s representative shall be either an employee of an independent installer that is certified by the SSMRS manufacturer to have two years of experience installing similar roof system.

1.2.2 Installer

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

1.3 DESIGN REQUIREMENTS

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

1.3.1 Design Criteria

Design criteria shall be in accordance with [\-MBMA-01-\] [\-ASCE 7-\] unless otherwise specified.

1.3.2 Dead Loads

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

1.3.3 Live Loads

1.3.3.1 Concentrated Loads

The panels and concealed anchor clips shall be capable of supporting a \~300 pound~\ temporary concentrated load at the panel midspan in the installed condition. The load shall be applied over the entire panel width. The panels shall support this concentrated load without displaying permanent distortions that would affect the weathertightness of the SSSMR system.

1.3.3.2 Uniform Loads

[AM#1]

The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of \~20 psf.~\

[AM#1]_____

1.3.4 Wind Loads

[AM#1]

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

a. Single fastener in each connection.....3.0

b. Two or more fasteners in each connection...2.25

1.3.5 Thermal Loads

[AM#1]

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

1.3.6 Framing Members Supporting the SSSMR System

Any additions/revisions to framing members supporting the SSSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. New or revised framing members and their connections shall be designed in accordance with \-AISI SG-673-\. Maximum deflection under applied live load, snow, or wind load shall not exceed 1/180 of the span length.

1.3.7 Roof Panels

Steel panels shall be designed in accordance with \-AISI SG-673-\. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length. Deflections shall be based on panels being continuous across three or more supports. Deflection shall be calculated and measured along the major ribs of the panels.

1.3.8 Accessories and Their Fasteners

Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof

panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. There shall be a minimum of two fasteners per clip. Single fasteners with a minimum diameter of \~3/8 inch~\ will be allowed when the supporting structural members are prepunched or predrilled.

1.4 PERFORMANCE REQUIREMENTS

The uplift resistance of the SSMR shall be established as indicated in the STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORMSTATICAIR PRESSURE DIFERENCE at the end of this Section. The SSMRS design shall be adequate for uplift if the established allowable pressure from testing causes no failure as defined in the STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE. Full scale testing is required to verify the adequacy of the SSMRS system. Once a SSMRS system of a manufacturer is found to be adequate for a specific loading condition, that certification may be used for future projects, as long as no changes are made in the system components.

1.5 SUBMITTALS

Government approval is required for submittals with a "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\

Design Analysis\; *GA*\.

Design analysis signed by a Registered Professional Engineer, prior to beginning of manufacture. The design anlysis shall include a list of the design loads, and complete calculations for the support system, roofing system and its components. The design analysis shall include, but not be limited to, the following wind and thermal information:

a. Wind force of various parts of the roof. Both positive and negative pressures shall be calculated with the controlling pressure summarized

b. Thermal movements that will result from the specified temperature range.

The calculations shall be accompanied by details from the manufacturer that demostrate haw installed concealed anchor clips and other roof system devices will accomodate the required thermal movement.

SD-04 Drawings\

Structural Standing Seam Metal Roof System\; *FIO*\.

Contractor's drawings and specifications; and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealant(s) and erection procedures. Drawings shall reflect the intent of the architectural

detailing using the manufacturer's proprietary products and fabricated items as required.

SD-08 Statements\

Qualifications\; *FIO*\.
[AM#1]
Qualifications of the manufacturer, installer, and field representative.

SD-09 Reports\

Test Report for Uplift Resistance of the SSSMR\; *GA*\.

SSSMR systems previously tested and approved by the Corps of Engineer's STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE are still valid. SSSMR systems not previously tested by the Corps of Engineer's test shall be tested in accordance with \-ASTM E 1592-\. SSSMR systems tested and certified shall also meet the additional specified requirements of this Section. To verify that the SSSMR system tested is the same as that proposed for this project, the report shall include the following information:

a. Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.

b. Details of the anchor clip, dimensions, and thickness.

c. Type of fasteners, size, and the number required for each connection.

d. Purlins/subpurlins size and spacing used in the test.

e. Description of the seaming operation including equipment used.

f. Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.

g. Any additional information required to identify the SSSMR system tested.

h. Signature and seal of an independent registered engineer who witnessed the test.

SD-13 Certificates\

Structural Standing Seam Metal Roof System\; *FIO*\.

a. Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips comply with specified requirements.

b. Certification that materials used in the installation are mill certified.

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

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

Insulation\; *GA*\.

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

Warranty\; *GA*\.

At the completion of the project, furnish a signed copy of the 5-Year Warranty for Standing Seam Metal Roof System (SSMRS), a sample copy which is attached to this Section.

SD-14 Samples\

Accessories\; *FIO*\.

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

Roof Panels\; *GA*\.

One piece of each type to be used, \~9 inches~\ long, full width.

Factory Color Finish\; *GA*\.

Three \~3 by 5 inches~\ samples of each type and color.

Fasteners\; *FIO*\.

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

Insulation\; *FIO*\.

One piece, \~12 by 12 inches,~\ of each type and thickness to be used, with a label indicating the rated permeance (if faced) and R-values. The flame spread, and smoke developed rating shall be shown on the label or provided in a letter of certification.

Gaskets and Insulating Compounds\; *FIO*\.

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

Sealant\; *FIO*\.

One sample, approximately \~1 pound,~\ and descriptive data.

Concealed Anchor Clips\; *FIO*\.

Two samples of each type used.

Subpurlins\; *FIO*\.

One piece, \~9 inches~\ long.

EPDM Rubber Boots\; *FIO*\.

One piece of each type.

1.6 DELIVERY AND STORAGE

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

1.7 WARRANTY

The standing seam metal roof system (SSMRS) shall be warranted as outlined below against water leaks, win damage, and deficient materials arising out of or caused by ordinary wear and tear by the ewlements at the site.

1.7.1 Contractor’s Weathertightness & Wind Damage Warranty for SSMRS

The Standing Seam Metal Roof System shall be warranted by the Contractor for a period of five (5) years against water leakage or any damage due to sustained winds up to and including the design wind speed of 90 MPH. The Standing Seam Metal Roof System covered under this warranty shall include the entire roofing system including but not limited to the standing seam metal roof panels, all of its accessories, components and trim, including all penetrations, such as pipe, vents, curbs, skylights, interior or exterior gutters and deownspouts, and eave, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed to provide a weathertight roof system, including items specified in other sections of these specifications, that become part of the Standing Seam Metal Roof System. All leaks and damage due to wind up to the design wind speed shall be repaired or replaiced as approved by the Contracting Officer and shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor may supplement this warranty with written warranties from the installer and/or manufacturer, which shall be submitted alongwith Contractor’s warranty. However the Contractor shall be ultimately responsible for this warranty. The Contractor’s written warranty shall be as outlined in attached example WARRANTY FOR STANDING SEAM METAL ROOF SYSTEMS (SSMRS), and shall start upon final acceptance of the facility or the date the Government takes possession, whichever is earliier. It is understood that the Contractor’s Performace Bond will remain effective throughout the five (5) year Contractor’s warranty period, for the entire Standing Seam Metral Roof System as outlined above.

1.7.2 Manufacturer’s Material Warranty for SSWRS

The Contractor shall furnish the following manufacturer’s material warranties. A manufacturer’s twenty (20) year material warranty that the aluminum, zinc-coated steel or aluminum-zinc coated steel as specified

herein, will not rupture, fail structurally, or perforate under normal atmopheric conditions at the site, shall be furnished in writing. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material. A manufacturer's twenty year exterior material finish warranty on the factory colored finish shall be furnished in writing that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate, will not chalk in excess of a numerical rating of eight (8) when measured in accordance with the standard procedures specified in ASTM D 659 and will not fade or change colors in excess of five (5) NBS units as measured per ASTM D 2244. Liability under this warranty is exclusively limited to refinishing or replacing the defective coated coil material. These material warranties shall include all coil materials furnished for SSMRS panels, flashing, accessories and trim fabricated from the coil material.

PART 2 - PRODUCTS

2.1 *ROOF PANELS*\

Panels shall be either steel or aluminum and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope when such slope is \~30 feet~\ or less. When length of run exceeds \~30 feet~\ and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than \~30 feet~\ may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than \~24 inches~\ of coverage in place. SSSMR system with roofing panels greater than \~12 inches~\ in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than 2 \~inches.~\ Standing seam rib spacing shall be 16 inches on center. Reference drawings for profile. All sheets shall be either square-cut or miter-cut except that gable end wall sheets may be cut in the shop to correspond to the roof slope and may have a horizontal joint at the eave line.

2.1.1 Steel Panels

Zinc-coated steel conforming to \-ASTM A 924-\ and \-ASTM A 653-\; aluminum-zinc alloy coated steel conforming to \-ASTM A 792-\, AZ 55 coating; or aluminum-coated steel conforming to \-ASTM A 463-\, Type 2, coating designation T2 65. Panels shall have a minimum thickness of \~0.024 inch~\, except that when the mid field of the roof is subject to design wind uplift pressures of \~60 psf~\ or greater the entire roof system shall have a minimum thickness of \~0.030 inch.~\ Panels shall be within 95 percent of tested thickness.

2.2 *CONCEALED ANCHOR CLIPS*\

Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.

2.3 *ACCESSORIES*\

Accessories shall be compatible with the covering furnished. Flashing, trim, metal closure strips, caps, roof curbs, and similar metal accessories shall be not less than the minimum thicknesses specified for roofing panels. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the covering and shall not absorb or retain water. Thermal spacer blocks and other thermal barriers at concealed clip fasteners shall be as recommended by the manufacturer.

2.4 *FASTENERS*\

Fasteners for steel roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for structural connections shall provide both tensile and shear ultimate strengths of not less than \~750 pounds~\ per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the covering to waterproof the fastener penetration. Washer material shall be compatible with the covering; have a minimum diameter of \~3/8 inch~\ for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately \~1/8 inch~\ thick. Exposed fasteners for factory color finished panels shall be factory finished to match the color of the panels.

2.4.1 Screws

Screws for attaching anchor devices shall be not less than No. 14. Other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

2.4.2 Bolts

Bolts shall be not less than \~1/4 inch~\ diameter, shouldered or plain shank as required, with locking washers and nuts.

2.4.3 Structural Blind Fasteners

Blind screw-type expandable fasteners shall be not less than \~1/4 inch~\ diameter. Blind (pop) rivets shall be not less than \~9/32 inch~\ minimum diameter.

2.5 *SUBPURLINS*\

Subpurlins shall have a minimum thickness of \~0.059 inches~\ and a minimum yield strength of \~50000 psi.~\

2.6 *FACTORY COLOR FINISH*\

Roof panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on fluoropolymer topcoat with an appropriate prime coat. Color shall match the color indicated in Section 09000; BUILDING COLOR AND FINISH SCHEDULE.

The exterior coating shall be a nominal \^0.025 mm^\ thickness consisting of a polyvinylidene fluoride topcoat of not less than \^0.018 mm^\ dry film thickness and the paint manufacturer's recommended primer of not less than \^0.005 mm^\ thickness. The interior color finish shall consist of a backer coat with a dry film thickness of \^0.013 mm^\ thick prime coat. The exterior color finish shall meet the test requirements specified below.

2.6.1 Salt Spray Test

A sample of the sheets shall withstand a salt spray test for a minimum of 1000 hours in accordance with \-ASTM B 117-\, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 8F, few No. 8 blisters,as determined by \-ASTM D 714-\; and a rating of ~1/8 inch~\ failure at scribe, as determined by \-ASTM D 1654-\.

2.6.2 Formability Test

When subjected to testing in accordance with \-ASTM D 522-\, the coating film shall show no evidence of fracturing to the naked eye.

2.6.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested for a minimum of 1000 hours in accordance with \-ASTM G 23-\, Method 2, using a Type EH apparatus with cycles of 60 minutes radiation and 60 minutes condensing humidity. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with \-ASTM D 3359-\, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with \-ASTM D 4214-\ test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with \-ASTM D 2244-\. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

2.6.4 Humidity Test

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

2.6.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with \-ASTM D 2794-\ equal to 1.5 times metal thickness in expressed in \~inch-pounds~\ with no loss of adhesion.

2.6.6 Abrasion Resistance Test

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

2.6.7 Specular Gloss

Finished roof surfaces shall have a specular gloss value of 10 or less at an angle of 85 degrees when measured in accordance with \-ASTM D 523-\.

2.6.8 Pollution Resistance

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

2.7 *INSULATION*

Aged thermal resistance (R-Values) shall not be less than 21.3 Sq. Ft degree F/BTUH Thickness of insulation shall be determined using an aged R-Value degree of 7.1 Sq. Ft. degree F/BTUH per inch. R-values shall be determined at a mean temperature of \~75 degrees F~\ in accordance with \-ASTM C 518-\. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation , including facings, shall have a flame spread not in excess of 75 and a smoke developed rating not in excess of 150 when tested in accordance with \-ASTM E 84-\. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory.

2.7.1 Rigid Board Insulation

[AM#1]
2.7.1.1 _____ Polyisocyanurate

_____ Polyisocyanurate insulation shall conform to \-ASTM C 1289-\, Type I, Class 2 (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For impermeable faced polyisocyanurate (Ex: aluminum foil) the maximum design R-value per 1-inch of insulation used shall be \~7.2.~\

2.8 STEEL SUPPORT PLATE

Provide 16 Ga. minimum support plate at all ridges, hips and valleys. Also provide a minimum 16 Ga. minimum support plate underneath all gutter assemblies.

2.9 *SEALANT*

Sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall be clear and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

2.10 *GASKETS AND INSULATING COMPOUNDS*

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

2.11 GUTTERS AND DOWNSPOUTS

[AM#1]

Provide 24 Ga. Minimum galvanized steel, gutters, conductor heads and downspouts per drawings of the same material, color and finish as the SSMRS roof panels.

2.12 *EPDM RUBBER BOOTS*

[AM#1]

Flashing devices around pipe penetrations and lightning rods shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

2.13 UNDERLAYMENTS

2.13.1 Felt underlayment

Felt underlayment shall be No. 30 felt in accordance with ASTM D 226, Type II.

2.13.2 Ruberized Underlayment

Ruberized underlayment shall be equal to “Ice and Water Shield” as manufactured by Grace Construction Products, “Winterguard” as manufactured by Certain Teed Coeporation, or “Weather Watch Ice and Water Barrier” as manufactured by GAF Building Materials Corporation.

[AM#1]

2.13.3 Slip Sheet

Slip sheet shall be 0.50 pound per square rosin sized unsaturated building paper.

[AM#1]

2.13.4 VAPOR RETARDER

The vapor retarder shall be polyethylene film conforming to \-ASTM D 2103-\, 10 mil minimum thickness.

PART 3 - EXECUTION

3.1 INSTALLATION

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

3.1.1 Subpurlins

Unless otherwise shown, subpurlins shall be anchored to the purlins or other structural framing members with bolts or screws. The subpurlin spacing shall not exceed \~30 inches~\ on centers at the corner, edge and ridge zones, and \~5 foot~\ maximum on centers for the remainder of the roof. Corner, edge, and ridge zones are as defined in \-ASCE 7-\.

3.1.2 Roof Panel Installation

Roof panels shall be installed with the standing seams in the direction of the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation. End laps of panels shall be

provided in accordance with the manufacturer's instructions. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings. Fasteners shall not puncture covering sheets except as provided for in the manufacturer's instructions for erection and installation. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings and other locations indicated on the manufacturer's drawings.

3.1.3 Concealed Anchor Clips

Concealed anchor clips shall be fastened directly to the structural framing members. The maximum distance, parallel to the seams, between clips shall be \~30 inches~\ on center at the corner, edge, and ridge zones, and \~5 feet~\ maximum on centers for the remainder of the roof.

3.2 INSULATION INSTALLATION

Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

3.2.1 Board Insulation

Rigid or semirigid board insulation shall be laid in close contact. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. Joints shall be tight and sealed with material recommended by manufacturer.

3.3 UNDERLAYMENT

3.3.1 Underlayment
[AM#1]
Underlayment types shall be installed where shown on the drawings; they shall be installed directly over the _____ insulation and purlins beneath the metal roof panel. Install a slip sheet as a top layer, beneath the metal roofing panels, to prevent adhesion. All underlayments shall be installed so that successive strips overlap the next lower strip un shingle fashion. Underlayment shall be installed in accordance with manufacturer’s written instructions, The underlayments shall ensure that any water that penetrates below the metal foofing panels will drain outside of the building envelope.

3.3.2 Rubberized Underlayment

[AM#1]

Ruberized underlayment shall be installed per manufacturer's written instructions at all roof edges, hips and valleys.

[AM#1]

3.3.3 Vapor retarder shall be installed over the structural metal deck on all Standing Seam Metal Roofs. The vapor retarder shall be installed to form a complete retarder to vapor infiltration. The joints shall be sealed with foil backed tape as recommended by the manufacturer.

3.4 CLEANING AND TOUCH-UP

Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.

- - o O o - -

FIVE (5) YEAR WARRANTY
FOR
STANDING SEAM METAL ROOF SYSTEM (SSMRS)

PROJECT DESCRIPTION AND LOCATION (Include Bldg. No.):
_____

CORPS OF ENGINEERS CONTRACT NUMBER:
_____

SPECIFICATION SECTION NUMBER & DESCRIPTION:
07416 STANDING SEAM METAL ROOF SYSTEM
_____

CONTRACTOR:
_____

ADDRESS:
_____

POINT OF CONTACT:
_____
TELEPHONE NUMBER:
_____

OWNER:
_____
_
ADDRESS:
_____
POINT OF CONTACT:
_____
TELEPHONE NUMBER:
_____

CONSTRUCTION AGENT:
_____
ADDRESS:
_____
POINT OF CONTACT:
_____
TELEPHONE NUMBER:
_____

THE ABOVE FACILITY IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5)YEARS AGAINST LEAKAGE OR ANY DAMAGE DUE TO SUSTAINED WINDS UP TO AND INCLUDING THE DESIGN WIND SPEED OF __ MILES PER HOUR (MPH). THE STANDING SEAM METAL ROOF SYSTEM (SSMRS) COVERED UNDER THIS WARRANTY SHALL INCLUDE THE ENTIRE ROOFING SYSTEM INCLUDING THE STANDING SEAM METAL ROOF PANELS, ALL OF ITS ACCESSORIES, COMPONENTS AND TRIM, INCLUDING ALL PENETRATIONS, SUCH AS PIPE, VENTS, CURBS, SKYLIGHTS, INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS, AND EAVE, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED TO PROVIDE A WEATHERTIGHT ROOF SYSTEM, INCLUDING ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS, THAT ARE PART OF THE STANDING SEAM METAL ROOF SYSTEM (SSMRS). ALL LEAKS AND DAMAGE DUE TO WIND UP TO THE DESIGN WIND SPEED SHALL BE REPAIRED OR REPLACED AS APPROVED BY THE CONTRACTING OFFICER AND SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

_____

(Company President)
(Date)

(SEE REVERSE SIDE FOR SUPPLEMENTAL PROVISIONS AND EXCLUSIONS)

FIVE (5)YEAR WARRANTY
FOR
STANDING SEAM METAL ROOF SYSTEM (SSMRS)

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

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTING, FIRE, EXPLOSIONS, HURRICANES, TORNADOES, EARTHQUAKES, HAIL AND SUSTAINED WINDS EXCEEDING __ MPH AS RECORDED AT THE NEAREST METEOROLOGICAL CENTER.

2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.

3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.

4. CORROSION CAUSED BY EXPOSURE TO MARINE (SALT WATER) ATMOSPHERE; CONSTANT SPRAY OF EITHER SALT OR FRESH WATER; CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.

5. FAILURE OF ANY PART OF THE SSMRS DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE FROM THE ROOF AND ALLOW PONDING WATER.
CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.

6. THIS WARRANTY APPLIES TO THE STANDING SEAM METAL ROOF SYSTEM (SSMRS), AND DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS, BUT WHICH SHALL BE COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.

7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES, UNLESS OTHERWISE APPROVED IN WRITING BY THE CONTRACTING OFFICER.

RECEIPT OF NOTICE BY TELEPHONE OR IN WRITING BY THE OWNER OR CONTRACTING OFFICER THAT LEAKS OR DAMAGE DUE TO WIND UP TO THE DESIGN WIND SPEED SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY AND WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THE SSMRS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN THE CONTRACTING OFFICER MAY HAVE THE STANDING SEAM METAL ROOF SYSTEM (SSMRS) REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

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

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

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.
Sealent (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 \~40 degrees F~\ or within \~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 \~ 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) \^_____^\ \~45-mil~\ 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:

Property	Value	Test Method
\~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 751
Low Temperature Flexibility at -40 degrees C	Pass	ASTM D 2136
Linear Dimension Change, max. percent (1 hour at 100 degrees C)	1.0	ASTM D 1204
Ply Adhesion, min., lbf/in.	10.0	ASTM D 413, Type A Specimen

Hydrostatic Resistance, min., psi	200	ASTM D 751, Method A
Puncture Resistance, min., lbs	225	FED-STD-101, Test Method 2031
Ozone Resistance (7 x Magnification 28 days/40 degrees C/100 pphm)	No cracks	ASTM D 1149, Method B
Accelerated Weather Resistance, 5,000 Hours (7 x Magnification)	No checking, cracking or crazing	ASTM D 2565 Type BH2
Fungi Resistance	No sustained 21 days growth or discoloration]~\	ASTM G 21,

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. <u>CSPE to be fully adhered application and by installing fasteners and plates.</u>

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 my result from the work of other trades.After complition 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 \^50 mm^\ \~2 inches~\, 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 \~8 inches~\ 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

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.

3.4 INFORMATION CARD

For each roof, provide a typewritten card, laminated in plastic for interior display, or a photoengraved \~0.032~\-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.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

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 \^mm per meter^\ \~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 manufacutrer'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.

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

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

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:

[ ] Metal
[ ] Cast-In-Place Concrete
[ ] Precast/Prestressed Concrete
[ ] Wood Plank or Plywood
[ ] Other _____

9. Type of Insulation Board:

[ ] Polyisocyanurate/Composite
[ ] Polystyrene/Composite
[ ] Perlite
[ ] Other _____
[ ] Polyisocyanurate Foam
[ ] Polystyrene
[ ] Mineral Fiber

10. Insulation Manufacturer: _____

11. Insulation Thickness: _____

12. Vapor Treatment: Total coverage [ ] Yes [ ] No

[ ] No Vapor Retarder
[ ] One Way Roof Vents
[ ] Other _____
[ ] Bituminous Vapor Retarder
[ ] Laminated Kraft Paper

13. Vapor Treatment Manufacturer(s): _____

14. Roofing Type:

[ ] Built-Up (Asphalt)
[ ] Built-Up (Coal-Tar)
[ ] Metal
[ ] Shingles
[ ] PIB
[ ] Modified Bitumen
[ ] CSPE
[ ] Other _____
[ ] TPA
[ ] EPDM
[ ] PVC

15. Roofing Manufacturer: _____

16. Roofing Installer/Warrantor: _____

17. Roofing Application Method:

[ ] Bitumen [ ] Fully Adhered [ ] Loose-Laid Ballasted
[ ] Mechanically Fastened [ ] Torched [ ] Other _____
[ ] 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 07600

SHEET METALWORK, GENERAL

10/94

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 167-\	(1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
\-ASTM B 32-\	(1995b) Solder Metal
\-ASTM B 209-\	(1995) Aluminum and Aluminum-Alloy Sheet and Plate
\-ASTM B 221-\	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
\-ASTM B 370-\	(1992) Copper Sheet and Strip for Building Construction
\-ASTM D 226-\	(1994) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
\-ASTM D 543-\	(1987) Resistance of Plastics to Chemical Reagents
\-ASTM D 822-\	(1995) Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus
\-ASTM D 828-\	(1993) Tensile Breaking Strength of Paper and Paperboard

\-ASTM D 1784-\	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
\-ASTM D 2822-\	(1991) Asphalt Roof Cement
\-ASTM D 3656-\	(1994) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
\-ASTM D 4022-\	(1994) Coal Tar Roof Cement, Asbestos Containing
\-ASTM D 4586-\	(1993) Asphalt Roof Cement, Asbestos Free
\-ASTM E 96-\	(1995) Water Vapor Transmission of Materials

INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

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

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA)

\-SMACNA-02-\	(1993) Architectural Sheet Metal Manual

1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction.

1.2.1 Coordination

Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Exposed edges shall be hemmed. Bottom edge of exposed vertical surfaces shall be broken in an angle to form drips. Flashing at the end of a run shalll be formed into a three dimensional configuration to direct water to the outside of the system. Joints shall be installed as specified in Table 1. Roof

Flanges of sheet matal shall be set in accordance with elastormeric (SDPE) roofing manufacturer’s recommendations.Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations. Factory fabricated components shall be packed in cartons marked with the manufacturer’s name or tradmark. Bulk materials, from which items are field fabricated, shall have manufacyturers’s name or trademark printed or embossed at frequent intervals to permit easy indentification. Sheet metalwork pertaining to heating, ventilating, and air conditioning is specified in DIVISION 15.

1.3 SUBMITTALS

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

SD-04 Drawings\

Materials\; *FIO*\.

Drawings of sheet metal items showing weights, gauges or thicknesses; types of materials; expansion-joint spacing; fabrication details; and installation procedures. Materials shall not be delivered untill after the approved detail drawings have been returned to the contractor.

SD-08 Statements\

Contractor Quality Control\; *FIO*\.

Quality Assurance Plan including a checklist of points to be observed prior to start of roofing work.

SD-14 Samples\; *FIO*\.

Samples of materials porposed for use, upon request.

1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage.

Materials shall be stored in dry, ventilated areas until immediately before installation.

PART 2 - PRODUCTS

2.1 *MATERIALS*\

[AM#1]

Any metal listed in TABLE I for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in TABLE I. Different items need not be of the same metal, except that if copper or copper clad stainless stell is selected for any exposed item, all exposed items shall be copper or copper clad stainless steel. All materials with roofing manufacturer's recommendations. All materials used for the elastomeric (CSPE) roofing assembly shall be in accordance with roofing manufacturer's recommendations. All materials used with the standing seam metal roofing system shall be in accordance with systems manufacturer's recommendations.

2.1.1 Accessories

Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided.

2.1.2 Aluminum Extrusions

\-ASTM B 221-\, Alloy 6063, Temper T5.

2.1.3 Bituminous Cement

Type I asphalt cement conforming to \-ASTM D 2822-\ or \-ASTM D 4586-\.

2.1.4 Sealant

Unless otherwise specified, sealant shall be an elastomeric weather resistant sealant as specified in Section \=07920=\ JOINT SEALING.

2.1.5 Fasteners

Fasteners shall be compatible with the fastened material and shall be the type best suited for the application.

2.1.6 Felt

\-ASTM D 226-\, Type I.

2.1.7 Polyvinyl Chloride (PVC) Reglets

\-ASTM D 1784-\, Class 14333D, 0.075 inch minimum thickness.

[AM#1]
2.1.8 Galvanized Steel

\-ASTM A 526-\ with coating designation G90, not chemically treated, not oiled, phosphatized, factory prefinished. Prefinished galvanized steel shall be factory primed and coated with a full strength flouoropolymer (containing a minimum of 70 percent Kynar 500 resin). Color shall be as indicated in SECTION 09999: BUILDING COLOR AND FINISH SCHEDULE. Prefinish coating shall carry a 20-year manufacturer's warranty against cracking, peeling, blistering, color change in excess of 5 NBS units as measured in accordance with \-ASTM D 2244-\, and chalking in excess of 8 as measured in accordance with \-ASTM D 4214-\. Refer to SECTION: 07416: STRUCTURAL STANDING SEAM METAL ROOF (SSMR) SYSTEM for speifications on the finishes required.

2.1.9 [AM#!]_____

_____
_____
_____

2.1.10 [AM#1]_____

_____

2.1.11 [AM#1]_____

_____

2.1.12 Solder

\-ASTM B 32-\, 95-5 tin-antimony.

2.1.12 Through-Wall Flashing

a. Electro-sheet copper not less than 5 ounces, factory coated both sides with acid- and alkali-resistant bituminous compound not less than 6 ounces per square foot or factory covered both

sides with asphalt-saturated cotton fabric, asphalt saturated glass-fiber fabric, or with 40 pound reinforced kraft paper bonded with asphalt.

b. Stainless steel, Type 304, not less than 0.003 inch thick, completely encased by and permanently bonded on both sides to 50 pound high strength bituminized crepe kraft paper, using hot asphalt, heat, and pressure.

c. Nonreinforced, waterproof, impermeable extruded elastomeric single ply sheeting not less than 30 mils thick.

Three ounce copper sheet, with 2 mils of dense, clear, polyethylene sheet bonded to each side of the copper.

d. Other through-wall flashing material may be used provided the following performance criteria are met.

(1) No cracking or flaking when bent 180 degrees over a 1/32 inchmandrel and rebent at the same point over the same mandrel in an opposite direction at 32 degrees F.

(2) Water vapor permeability not more than 2 perms when tested in accordance with \-ASTM E 96-\.

(3) Minimum breaking strength of 90 pounds per inch width in the weakest direction when tested in accordance with \-ASTM D 828-\.

(4) No visible deterioration after being subjected to a 400-hour direct weathering test in accordance with \-ASTM D 822-\.

(5) No shrinkage in length or width and less than 5 percent loss of breaking strength after a 10-day immersion, per \-ASTM D 543-\, in 5 percent (by weight) solutions, respectively, of sulfuric acid, hydrochloric acid, sodium hydroxide or saturated lime (calcium hydroxide).

[AM#1]
2.1.13 Louvers

Louvers shall be fabricated of galvanized steel or stainless steel in accordance with the details shown in SMACNA-02. Fixed blades shall be accurately fitted and firmly secured to the frame by riveting and soldering. The edges of louver blades shall be folded or beaded for rigidity, and baffled to exclude driving

rain. Louvers shall bear the AMCA Certified Ratings Seal for air performance and water penetration ratings as described in AMCA 500.

[AM#1]
2.1.14 Louver Screen

Provide bird screens as indicated of commercial bronze or carbon steel conforming to ISWA IWS 009.

PART 3 - EXECUTION

3.1 GENERAL

[AM#1]
Items such as gutters, conductor heads and downspouts shall be fabricated in conformance with \-SMACNA-02-\ and as indicated. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 1/2 inchhem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing.

3.2 EXPANSION JOINTS

Expansion joints shall be provided as indicated. Expansion joints in continuous sheet metal shall be provided at 40 foot intervals for copper and stainless steel and at 32 foot intervals for aluminum, except extruded aluminum fasciae which shall have expansion joints at not more than12 footspacing. Joints shall be evenly spaced. An additional joint shall be provided where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing.

3.3 PROTECTION OF ALUMINUM

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

3.3.1 Paint

Aluminum surfaces shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint as specified in Section \=09900=\ PAINTING, GENERAL.

3.3.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and cemented to the aluminum surface using a cement compatible with aluminum.

3.4 CONNECTIONS AND JOINTING

3.4.1 Soldering

Soldering shall apply to copper, and stainless steel items. Edges of sheet metal shall be pretinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of lead coated meaterial to be soldered shall be scraped or wire brushed to produce a bright surface, and seams shjall have a liberal amount of flux brushed in before soldering is begun. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

3.4.2 Riveting

Joints in aluminum sheets 0.040 inch or less in thickness shall be mechanically made.

3.4.3 Seaming

Flat-lock and soldered-lap seams shall finish not less than 1 inch wide. Unsoldered plain-lap seams shall lap not less than3 inches unless otherwise specified. Flat seams shall be made in the direction of the flow.

3.5 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Continuous cleats shall be at least one gauge heavier than the metal held down by the cleaty. Butt joints of cleats shall be spaced approximately 1/8 inchapart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 12 inches on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and

shall be driven in expansion shields set in concrete or masonry. The cleat for fascia anchorage shall be installed to extend below supporting construction to form a drip and to allow the flashing to be hooked over the edge at least 3/4". The cleat shall be of suffiecient width to insure a rigid installation. Where horizontal nailer is vented insulation and the cleat is placed over masonry or concret, the cleat shall be installed over 1.585 mm washers place at screws. Washers shall be of metal that is electrolyticlly comparible with the continuous cleat.

[AM#1]

3.6 GUTTERS, CONDUCTOR HEADS AND DOWNSPOUTS

[am#1]

Gutters, conductor heads and downspouts shall be installed as indicated. Gutters shall be supported as indicatedandorby cleats spaced not less than 36 inches apart. Downspouts shall be rigidly attached to the building. Supports for downspouts shall be spaced according to manufacturer's recommendations.

3.7 FLASHINGS

Flashings shall be installed at locations indicated and as specified below. Sealing shall be according to the flashing manufacturer's recommendations. Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof, and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement. Flashing shall be formed to direct water to the outside of the system.

3.7.1 Base Flashing

Metal base flashing shall be coordinated with roofing work. Metal base flashing shall be set in plastic bituminous cement over the roofing membrane, nailed to nailing strip, and secured in place on the roof side with nails spaced not more than \^75 mm^\ \~3 inches~\ on centers. Metal base flashing shall not be used on built-up roofing.

3.7.2 Counter Flashings

Except as otherwise indicated, counter flashings shall be provided over base flashings. Counter flashing shall be installed as shown in \-SMACNA-02-\. Where bituminous base flashings are provided, the counter flashing shall extend down as close as practicable to the top of the cant strip. Counter flashing shall be factory formed to provide spring action against the base flashing.

3.7.3 Stepped Flashing

Stepped flashing shall be installed where sloping roofs surfaced with shingles abut vertical surfaces. Separate pieces of base flashing shall be placed in alternate shingle courses.

3.7.4 Through-Wall Flashing

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further into the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

3.7.4.1 Lintel Flashing

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 2 inches,or shall be applied over top of masonry and precast concrete lintels. Bedjoints of lintels at control joints shall be underlaid with sheet metal bond breaker.

3.7.4.2 Sill Flashing

Sill flashing shall extend the full width of the sill and not less than 4 inches beyond ends of sill except at control joint where the flashing shall be terminated at the end of the sill.

3.7.5 Valley Flashing

Valley flashing shall be installed as specified in \-SMACNA-02-\ and as indicated.

3.8 FASCIA

Sheets shall be fabricated with out longitudinal joints except where two-piece fasciae are used when fascia depth exceeds 7". Provision for expansion shall be located at joints. Factory fabricated internal and external corner units with mitered joints shall be provided. Roof flange and splice plate of the gravel stop and fascia shall extend out on the roofing felt. Roof flange shall be secured with nails spaced not greater than 3" on center, located within 1" of the outer edge of the flange. The fascia shall not be face nailed except as specified for two piece fasciae. The upper piece of two-piece fasciae shall be the same as specified above, except that the fascia depth shall be at least 3 ½" and it shall overlap the lower fascia piece by not less than 2". The lower piece shall be hooked ½" over the edge strip and splice plate and face nailed on 12" centers, 1" below the top of the sheet. The upper fascia shall be hemmed ½" at the lower edge and formed to fit tightly against the lower fascia. Either smooth or corrugated sheets may be used.

3.9 REGLETS

Reglets shall be a factory fabricated product of proven design, complete with fittings and special shapes as required. Open-type reglets shall be filled with fiberboard or other suitable separator to prevent crushing of the slot during installation. Reglet plugs shall be spaced not over12 incheson centers and reglet grooves shall be filled with sealant. Friction or slot-type reglets shall have metal flashings inserted the full depth of slot and shall be lightly punched every 12 inches to crimp the reglet and counter flashing together. Polyvinyl chloride reglets shall be sealed with the manufacturer's recommended sealant.

[AM#1]
3.10 INSTALLATION OF LOUVERS

Louvers shall be rigidly attached to the supporting construction. The installation shall be rain tight. Louver screens shall be installed as indicated.

[AM#1]
3.11 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the

contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.

b. Verification of compliance of materials before, during, and after installation.

c. Inspection of sheet metalwork for proper size and thickness, fastening and joining, and proper installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer at the end of each day.

TABLE 1. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES [AM#1]

Item Description				Galvanized steel, gage
EXPOSED SHEET METAL:				
Waterstop - bellows or flanged-U-type.....		---	---	24
Cleats (Continuous)...				20
Covering on minor flat, pitched or curved surfaces.....		---		24
Downspouts, heads and leaders.....			---	24
Flashings:				
Base.....		---	---	24
Cap, stepped or valley.....			---	24
Fasciae				
Extrusions	--		---	---
sheets, corrugated			---	24
sheets, smooth	--		---	24
Gutters (girth):				
Up to 15 inches.....			---	26
15 to 20 inches.....			---	24
20 to 25 inches.....			---	22
25 to 30 inches.....			---	20
Gutter brackets (girth):				
Up to 15 inches.....			---	1/8"x1"
15 to 20 inches.....			---	1/8"x1-1/2"
20 to 24 inches.....			---	1/8"x2"

TABLE 1. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES (continued)
[AM#1]

Item Description				Galvanized steel, gage
Gutter cleats and cover plates.....			---	26
Scupper, conductor head and lining.....			---	25
Strainers (wire gage).....			---	No. 12
Reglets.....		---	---	---
Counterflashings.....		---	---	24
Pressure Bars.....		---	---	1/4x3/16x2"
Expansion Joint Curb Clip.....	---	---	---	1/8x8"
Counterflashing Receiver.....		---	---	20
Cradle Support.....		---	---	3/16xl"
Sanitary Vent Pipe Flashing*.....		---	---	24
Tubular Penetration Flashing.....		---	---	24
"H" Column hood flashing.....	---	---	---	16
Bond breaker.....		---		---

*4 lb. lead and preformed neoprene also recommended for metal and PVC pipes, respectively.

TABLE 1. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES (continued)
[AM#1]

Item Description				Galvanized steel, gage
Copings.....				25
Pitch pockets.....		---	---	24
Through-wall, flashings above roof line.....		---		---
Through-wall, below roof line, except as otherwise specified in paragraph MATERIALS		---		---

TABLE 2. SHEET METAL JOINTS

[AM#1]

Item Designation	Type of Joint: _____ Galvanized Steel, _____ _____	_____	Remarks
Building expansion joint at roof	1-1/4 inch single lock standing seam, cleated.	_____ _____ _____	-----
Cleats (Continuous)	Butt	____	-----
Flashings:			
Base	1-inch, flat locked, soldered.	_____ _____ _____	Use hard setting sealant for locked aluminum joints
	3-inch lap for expansion joint.	_____ _____ _____	Each expansion joint for all metals shall have one continuous strip of 1/16-inch thick by 1/4-inch wide preformed tape sealant.
Cap-in reglet	3-inch lap.	_____	Seal groove with elastomeric sealant (a).
Cap - two-piece	Receiver 3-inch lap. Cap piece 3-inch lap.	-----	-----
Stepped	3-inch lap.	_____	-----

Through-wall spandrel flashing (metal)	1-1/2 inch mechanical interlock.	-----	-----

TABLE 2. SHEET METAL JOINTS (Cont)

[AM#1]

Item Designation	Type of Joint: Galvanized Steel,	Type of Joint:	Remarks
Through-wall spandrel flashing (Coated or non-metal)	-----	-----	3 inch lap with sealant
Valley	6-inch lap, cleated.		-----
Gutters	1-1/2 inch lap, riveted and soldered.		Use hard setting sealant for locked aluminum joints.
Pitch pockets	1-inch soldered lap.		Use hard setting sealant for locked aluminum joints.
Reglets	Butt joint.	-----	Seal reglet groove with elastomeric sealant.(a)

(a) Polyvinyl chloride type reglet shall be sealed with manufacturer's recommended butyl rubber sealant.

- - o O o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 07810 - UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK IN THIS SECTION

1.1.1 This section covers all translucent panels, skylight work and related items as indicated on drawings and specified herein.

1.2 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, INC (ANSI)

\-ANSI Z97.1-\	(1989) Safety Glazing Materials Used in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 236-\	(1989) Standard Test Methods for Steady-State Thermal Performance of Building Assembley by Means of a Guarded Hot Pot
\-ASTM C 297-\	(1986; R 1991) Standard Descriptive Nomenclature for Constituents of Natureal Mineral Aggregates
\-ASTM D 635-\	(1991) Standard Test Methods for Rate of Burning and /or Extent and Time of Burning of Self-Suppotting Plastices in a Horizontal Position
\ASTM D1002-\	(1994) Standard Test Methods for Strength of Single-Lap Joint Adhesively bonded Specimens by Tension Loading (Metal-to-Metal)
\-ASTM D 1037-\	(1995) Standard Test Methods for Evaluating Porperties of Wood-Base Fiber and Particle Board Panel Materials
\-ASTM D1435-\	(1994) Standard Practice for Outdoor Weathering of Plastics
\ASTM E 72-\	(1993) Standard Test Methods for Calculation of Color Diffe3rences From Instrumentally Measured Color Coordinates
\-ASTM E 84-\	(1984; Rev A95) Standard Test Methods for Surface Burning Characteristics of Building Materials

\ASTM E 108-\	(1995) Standard Test Methods for Fire Tests for Roof Covering
\-ASTM E 330-\	(1990) Standard Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

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-01 Data\

Skylights\; *FIO*\.

Manufacturer's catalog data shall include cleaning instructions as recommended by the manufacturer.

SD-04 Drawings\

Skylights\; *FIO*\.

Drawings shall show location of each type of skylight with fully dimensioned drawings including the details of construction, gauges of metal, glazing, details and methods of anchorage, and installation.

SD-06 Instructions\

Skylights\; *FIO*\.

Manufacturer's installation instructions.

SD-09 Reports\

Test Reports\; *FIO*\.

Reports for each of the following tests shall be submitted:

Flame Spread and Smoke Development (ASTM E 84)

Burn Extent (ASTM D 635)

Color Difference (ASTMD 2244)

Impact Strength (SPI Method)

Bond Strength (ASTM C 297 and ASTM D 1002

Accelerated Aging (ASTM D 1037)

Beam Bending Strenght (ASTM D 1037)

Panel Strength (ASTM E 72)

Insulated “U” Factor (ASTM C 236)

[AM#1] Class A covering Burning Brand (ASTM E 108)

SD-10,Design Analysis and Calculations

Design calculations shall indicate compliance with dead load, 20 psf live load, and 90 miles per hour (ASCE 7-95) wind load requirements.

PART 2 - PRODUCTS

2.1 GENERAL

Unit skylights shall be of the square pyramid type, and be the product of a manufacturer regularly engaged in the manufacture of roof skylights. The skylight shall be of the sizes indicatedand shall be furnished complete with bases, flashing flanges, and glazing. The skylights shall be waterproof and weatherproof. Continuous runs of skylights shall be constructed in sections suitable for shipment and installation. Joints between sections shall be made and gasketed in such a manner as to be waterproof and shall properly allow for expansion and contraction.

2.2 GLAZING

[AM#1]
Translucent facings shall be fiberglass reinforced polyester sheet specifically manufactured for use in the manufacture of translucent sandwich panels.

A. The interior face sheet shall have a flame spread rating no greater than 25 and smoke development no greater than 450 when tested in accordance with ASTM E 84.

B. The exterior face shall have a tough, inert protective coating factory applied by a licensed sheet manufacturer for architectural use. The coating shall be 0.05 mm minimum thickness for maximum protection of weatherablility, color stability and against fiberbloom. The exterior sheet shall be specially formul.ated with colorfast resins to further protect the shee from color change. This coating shall be fully field refinishable if damaged.

1. The face sheet shall be uniform in color to prevent splotchgy appearance.

[AM#1] 2. Exteruior face sheet shall be 1/16-inch thick and clear in color.

[AM#1] 3. Interior face sheet shall be 1/16-inch thick and clear in color.

2.2.1 Panel Construction

[AM#1] Wall panels shall have a minimum thickness of 2 3/4-inch. Wall panels shall be a true sandwich panel of flat fiberglass sheet bonded to a grid core of mechanically interlocking aluminum I-beams and shall be laminated under a controlled process of heat and pressure.

2.3 UNIT FRAME
[AM#1]
The unit frame shall be fabricated of extruded 6063-T5 aluminum, shall be thermally broken, and shall have reinforced and full penetration welded mitered corner joints, integral condensation drainage gutter and seepage ports, integral curb frame mounting flange and cap flashing to receive the roof flashing system and be designed for mounting as indicated on drawings. Skylights to be installed on a membrane roofing shall be suitable for raised curb mounting.A gasket shall be provided between all points of contact between glazing surface and metal frame. Frame shall have anodized finish, color as specified in Section \=09000=\ BUILDING COLOR AND FINISH SCHEDULE.

2.4 CURBS

Metal curb shall be of factory-formed, double wall construction, 4inches~\ high, fabricated of 3003-H aluminum, minimum of 0.063-inch thick, or 18-gauge galvanized steel. Double wall construction shall have minimum 1-inch thick rigid insulation between metal liner faces of not less than 26 gauge.Curbs shall be provided with integral cap flashing of the same gauge and metal as the curb and with base flashing flanges that extend not less than 3 inches over the adjoining roof surface to provide proper connection with the roof. Curbs and cap flashing shall be fully welded and grounded at corners for weathertightness. All welding shall be even and smooth. Curbs shall be adequately reinforced and well braced with joints properly formed. Galvanic action between different metals in direct contact shall be prevented by nonconductive separators.

2.5 Design and Fabrication
[AM#1]
Exterior skylights shall be disigned for compliance with dead load, 20 psf live load, and for basic wind speed of 90 miles

per hour (ASCE 7-95) wind load requirements. Deflections shall be limited to L/60 for panels and to L/175 for framing memnbers.

PART 3 - EXECUTION

3.1 INSTALLATION

Unless otherwise indicated, skylights, including curbs, shall be installed in accordance with the manufacturer's recommendations. Installation shall be coordinated with the installation of the roofing system and related flashings. Anchors, attachments, and other items to be built-in shall be coordinated for installation as the work progresses. Skylights shall be rigidly installed and free from vibration due to wind. Connection to the building structure shall provide a watertight connection.

3.1.1 Protection of Aluminum

Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

a. Paint: Aluminum surfaces to be protected shall be solvent cleaned and given a coat of zinc-chromate primer and one coat of aluminum paint.

b. Nonabsorptive Tape or Gasket: Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and shall be cemented to the aluminum surface using a cement compatible with aluminum.

3.2 CLEANUP

After installation, glazing, framing, curbs, and accessories shall be cleaned. Glazing shall be left in clear, scratch free condition inside and out. Cleaning shall be in accordance with the manufacturer's instructions.

- - o 0 o - -

SECTION 07900

JOINT SEALING

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 C 509-\	(1994) Elastomeric Cellular Preformed Gasket and Sealing Material
\-ASTM C 570-\	(1995) Oil- and Resin-Base Caulking Compound for Building Construction
\-ASTM C 576-\	(1983) Glass Fiber Yarns
\-ASTM C 734-\	(1993) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
\-ASTM C 834-\	(1995) Latex Sealants
\-ASTM C 920-\	(1994) Elastomeric Joint Sealants
\-ASTM C 1085-\	(1991) Butyl Rubber-Based Solvent-Release Sealants
\-ASTM C 1184-\	(1995) Structural Silicone-Sealants
\-ASTM D 217-\	(1994) Cone Penetration of Lubricating Grease
\-ASTM D 1056-\	(1991) Flexible Cellular Materials - Sponge or Expanded Rubber
\-ASTM E 84-\	(1996a) Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

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

SD-01 Data\

Backing\; *FIO*\.

Bond-Breaker\; *FIO*\.

Sealant\; *FIO*\.

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

SD-13 Certificates\

Sealant\; *FIO*\.

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL REQUIREMENTS

[AM#1]

The ambient temperature shall be within the limits of _____ \~40 to 90 degrees F~\ when the sealants are applied.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall include the following information as applicable: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures between \~40 and 90 degrees F~\ unless otherwise specified by the manufacturer.

PART 2 - PRODUCTS

2.1 *BACKING*\

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

2.1.1 Rubber

Cellular rubber sponge backing shall be \-ASTM D 1056-\, Type 2, closed cell, Class A, Grade round cross section.

2.1.2 Synthetic Rubber

Synthetic rubber backing C shall be \-ASTM C 509-\, Option I, Type I, preformed rods or tubes.

2.2 *BOND-BREAKER*\

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.3 PRIMER

Primer shall be non-staining type as recommended by sealant manufacturer for the application.

2.4 CAULKING

Oil- and resin-based caulking shall be \-ASTM C 570-\, Type 1. Unless otherwise specified, caulking compound shall be used on interior applications for caulking in wood or masonry; in the short joints between masonry surfaces, wood surfaces, or metal surface where limited movement is anticipated; and under seats of door thresholds. Backstop material for use in fire-rated partitions shall be glass fiber yarn conforming to ASTM D 578.

2.5 *SEALANT*\

2.5.1 LATEX

Latex Sealant shall be \-ASTM C 834-\.

2.5.2 ELASTOMERIC

Elastomeric sealants shall conform to \-ASTM C 920-\ and the following:

a. Polysulfide Sealant: Type Sealant B M, Grade NS, Class 25, Use NT, MGAO where applicable.

b. Polyurethane sealant: Sealant C Grade NS P, Class 25, Use TNTMGAO where applicable.

c. Silicone sealant Sealant D: Type SM, Grade NSP, Class 25, Use NT, MGAO where applicable.

d. Structural silicone sealant Sealant E: \-ASTM C 1184-\, Type SM, Use GO where applicable.

Sealants B thru E shall be used where applicable on exterior applications for sealing control joints and expansion and other movable joints in concrete, masonry, and metal where cyclic movement is anticipated , metal reglets joints occurring between ends of gravel stops, fasciae, and copings and adjacent walls, and both exterior and interior surfaces formed between pipes and pipe sleeves. This sealant shall not be used in sealing joints adjacent to asphalt or bituminous materials.

2.5.3 ACOUSTICAL

Rubber or polymer-based acoustical sealant F shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with \-ASTM E 84-\. Acoustical sealant shall have a consistency of 250 to 310 when tested in accordance with \-ASTM D 217-\, and shall remain flexible and adhesive after 500 hours of accelerated weathering as specified in \-ASTM C 734-\, and shall be non-staining.

Acoustical sealant shall be used to seal joints or other openings occurring a perimeter of, or within partitions having specific sound transmission requirements as shown in drawings.

2.5.4 BUTYL

Butyl sealant G shall be \-ASTM C 1085-\.

2.5.5 PREFORMED

Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus \~30 to plus 160 degrees F,~\ the sealant shall be non-bleeding and shall have no loss of adhesion.

Preformed sealant shall be used in compression seals such seals between metal plates or at sheet metal expansion joint laps. Also use at cap flashing in parapet walls.

2.5.5.1 Tape Sealant

Tape sealant H: cross-section dimensions shall be 1/2" x 1/2".

2.5.5.2 Bead Sealant

Bead sealant I: cross-section dimensions shall be 1/2"x1/2".

2.5.5.3 Foam Strip

Foam strip J shall be polyurethane foam; cross-section dimensions shall be 1/2"x1/2". Foam strip shall be capable of sealing out moisture, air, and dust when installed and compressed as recommended by the manufacturer. Service temperature shall be \~minus 40 to plus 275 degrees F.~\ Untreated strips shall be furnished with adhesive to hold them in place. Adhesive shall not stain or bleed into adjacent finishes. Treated strips shall be saturated with butylene waterproofing or impregnated with asphalt.

Foam strip sealant shall be used in compression in roof expansion joints. Untreated strips shall be used at perimeter seals of ceilings to interior walls.

2.6 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

3.1.1 Surface Preparation

The surfaces of joints to receive sealant or caulk shall be free of all frost, condensation and moisture. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant. Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

3.1.4 Aluminum Surfaces

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

3.1.5 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

3.2 APPLICATION

3.2.1 Masking Tape

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

3.2.2 Backing

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

3.2.3 Bond-Breaker

Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

3.2.5 Sealant

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as noted herein and/or as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth (per TM and manufacturer’s recommendations for condition) without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be dry tooled to produce a uniformly smooth surface free of wrinkles and to ensure full adhesion to the sides of the joint; the use of solvents, soapy water, etc., will not be allowed. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

- - o O o - -

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 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 typeas 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*\

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-\.

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#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-\, except that bituminous coating of the interior surfaces of fully grouted frames will not be required unless corrosive additives are present in the grout mix. 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.

- - o 0 o - -

SECTION 08120

ALUMINUM DOORS, FRAMES AND WINDOW WALL

03/94

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

\-AA DAF-45-\	(1980; R 1993) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

\-AAMA 605.2-\	(1992; Addenda Jan 1995) Voluntary Specification for High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels
\-AAMA 1503.1-\	(1988) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM B 209-\	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
\-ASTM B 221-\	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
\-ASTM E 283-\	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

\-ASTM E 330-\	(1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
\-ASTM E 331-\	(1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

1.2 SYSTEM DESCRIPTION

[AM#1]

Swing-type aluminum doors frames and window wall, of size and design shown on the drawings, shall be provided at the locations indicated. Doors shall be furnished complete with frames, subframes, transoms, adjoining sidelights, adjoining window wall, trim, and other accessories indicated and specified for complete installation. Adjoining sidelights and window walls shall have horizontal safety rails.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Wind Load Performance

[AM#1]

Doors, frames and window walls shall be of sufficient strength to withstand a design wind load of 30 pounds per square foot of supported area with a deflection of not more than 1/175 times the length of the member. Doors shall be tested in accordance with \-ASTM E 330-\ at a pressure not less than 1.5 times the design load.

1.3.2 Water Penetration Performance

Frames and fixed areas, and non-handicap complying doors shall have no water penetration when tested in accordance with \-ASTM E 331-\ at a pressure of 8psf.

1.4 SUBMITTALS

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

SD-01 Data\

Aluminum Doors, Frames and Window Wall\; *FIO*\.

Manufacturer's descriptive data and catalog cuts including air-infiltration data.

SD-04 Drawings\

Aluminum Doors and Frames\; *FIO*\.

A schedule showing the location of each door shall be included with the drawings. Drawings showing elevations of each door frame type, and window wall details and method of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, and details of joints and connections.

SD-06 Instructions\

Installation\; *FIO*\.

Cleaning\; *FIO*\.

Manufacturer's installation instructions and cleaning instructions.

SD-09 Reports\

Full-Glazed and Flush Doors\; *FIO*\.

For full-glazed and flush doors, certified test reports from an independent testing laboratory, stating that doors are identical in design, materials, and construction to a door that has been tested and meets all test and specified requirements.

SD-14 Samples\

Finishes\; *FIO*\.

Samples of the color anodized coating, showing the extreme color range.

1.5 DELIVERY AND STORAGE

Materials delivered to the jobsite shall be inspected for damage, and shall be unloaded with a minimum of handling. Storage shall be in a dry location with adequate ventilation, free from dust, water, and other contaminants, and which permits easy access for inspecting and handling. Materials shall be neatly stored on the floor, properly stacked on

nonabsorptive strips or wood platforms. Doors and frames shall not be covered with tarps, polyethylene film, or similar coverings.

1.6 WARRANTY

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

PART 2 PRODUCTS

2.1 ALUMINUM DOORS, FRAMES AND WINDOW WALL

Extrusions shall comply with \-ASTM B 221-\, Alloy 6063-T5 except alloy used for anodized color coatings shall be required to produce the specified color. Aluminum sheets and strips shall comply with \-ASTM B 209-\, alloy and temper best suited for the purpose. Fasteners shall be hard aluminum or stainless steel.

2.1.1 *Finishes*\

Finish shall be color anodized. Color anodized finish shall be [AA-M10C22A32] [AA-M10C22A34] [AA-M10C22A42] [AA-M10C22A44] in accordance with the requirements of \-AA DAF-45-\. Color shall be in accordance with Section \=09000=\ BUILDING COLOR AND FINISH SCHEDULE.

2.1.2 Welding and Fastening

Where possible, welds shall be located on unexposed surfaces. Welds required on exposed surfaces shall be smoothly dressed. Welding shall produce a uniform texture and color in the finished work, free of flux and spatter. Exposed screws or bolts will be permitted only at inconspicuous locations and shall have heads countersunk.

2.1.3 Anchors

[AM#1]

Anchors shall be stainless steel or steel with a hot-dipped galvanized finish. Anchors of the sizes and shapes required shall be provided for securing aluminum frames to adjacent construction. Anchors shall be placed near top and bottom of each jamb and at intermediate points not more than 25 inches apart. Transom bars shall be anchored at ends, and mullions shall be anchored at head and sill. The bottom of each frame shall be anchored to the rough floor construction with

_____ \~3/32 inch~\ thick stainless steel angle clips secured to the back of each jamb and to floor construction. Stainless steel bolts and expansion rivets shall be used for fastening clip anchors.

2.1.4 Provisions For Hardware

Hardware for aluminum doors is specified in Section \=08700=\ BUILDERS' HARDWARE. Doors and frames shall be cut, reinforced, drilled, and tapped at the factory to receive template hardware. Reinforcement shall be provided in the core of doors as required to receive locks, door closers, electric strikes and other hardware. Doors to receive surface applied hardware shall be reinforced as required.

2.1.5 Provisions For Glazing

Glazing shall be as specified in Section \=08810=\ GLASS AND GLAZING. Metal glazing beads, vinyl inserts, and glazing gaskets shall be provided for securing glass. Glass stops shall be tamperproof on exterior side.

2.1.6 Weatherstripping

Weatherstripping shall be continuous silicone-treated wool pile type, or a type recommended by the door manufacturer, and shall be provided on head and jamb of exterior doors. Weatherstripping for bottom of doors shall be as shown. Weatherstripping shall be easily replaced without special tools, and shall be adjustable at meeting stiles of pairs of doors. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with \-ASTM E 283-\ at standard test conditions.

2.2 FABRICATION OF ALUMINUM FRAMES

Frames shall be double-glazed and shall have a minimum condensation resistance factor of 45 in accordance with \-AAMA 1503.1-\. Frames shall be fabricated of extruded aluminum shapes to contours as shown on the drawings. Shapes shown are representations of design, function, and required profile. Dimensions shown are minimum. Shapes of equivalent design may be submitted, subject to approval of samples. Minimum metal wall thickness shall be 0.090 inch, except glazing beads, moldings, and trim shall be not less than 0.050 inch. Frames that are to receive glass shall have removable snap-on glass stops and glazing beads. Joints in frame members shall be

milled to a hairline watertight fit, reinforced, and secured mechanically by steel clip arrangement or by screw spline attachment.

2.2.1 Horizontal Safety Rails

Rails shall be of the same style, design, and finish as the doors and frames, and shall be mounted at the same height as push-pull bars and exit devices. Rails may be on either side of the glass. The exposed vertical face shall be not less than 1 1/2 inches wide.

2.3 FABRICATION OF ALUMINUM DOORS

2.3.1 Sizes, Clearances, and Edge Treatment

Doors shall be not less than 1-3/4 inches thick. Clearances shall be 1/16 inch at hinge stiles, 1/8 inch at lock stiles and top rails, and 3/16 inch at floors and thresholds. Single-acting doors shall be beveled 1/8 inchat lock and meeting stile edges. Double-acting doors shall have rounded edges at hinge stile, lock stile, and meeting stile edges.

2.3.1.1 Full-Glazed Stile and Rail Doors

Doors shall have medium stiles and rails as shown, and shall be fabricated from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Doors shall be double-glazed and shall have a minimum condensation resistance factor of [45] in accordance with \-AAMA 1503.1-\. Top and bottom rail shall be fastened together by means of welding or by 3/8 inch diameter cadmium-plated tensioned steel tie rods. Extruded aluminum snap-in glazing beads shall be provided on interior side of doors. Extruded aluminum theft-proof snap-in glazing beads or fixed glazing beads shall be provided on exterior or security side of doors. Glazing beads shall have vinyl insert glazing gaskets, designed to receive glass of thickness required. Glass is specified in Section \=08810=\ GLASS AND GLAZING.

PART 3 EXECUTION

3.1 INSTALLATION OF DOORS, FRAMES, AND ACCESSORIES

3.1.1 Protection of Aluminum

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods.

3.1.1.1 Paint

Aluminum surfaces to be protected shall be solvent cleaned and given a coat of zinc-molybdate primer and one coat of aluminum paint.

3.1.1.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and shall be cemented to the aluminum surface using a cement compatible with aluminum.

3.1.2 *Installation*\

Frames and framing members shall be accurately set in position to receive doors, transoms,and adjoining sidelights. Frames shall be plumb, square, level, and in alignment, and securely anchored to adjacent construction. Metal-to-metal joints between framing members shall be sealed as specified in Section \=07920=\ JOINT SEALING. Doors shall be accurately hung with proper clearances, and adjusted to operate properly. Protective coverings if provided shall be removed and the doors and frames shall be thoroughly cleaned.

- - o 0 o - -

SECTION 08210

WOOD DOORS

05/97

PART
1 GENERAL
[AM#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 HARDBOARD ASSOCIATION (AHA)

\-AHA 135.4-\	(1995) Basic Hardboard

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

\-AWI-02-\	(1994) Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 80-\	(1995) Fire Doors and Windows
\-NFPA 101-\	(1997) Safety to Life from Fire in Buildings and Structures
\-NFPA 252-\	(1995) Fire Tests of Door Assemblies

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

\-NWWDA I.S. 1-A-\	(1993) Architectural Wood Flush Doors
\-NWWDA I.S. 4-\	(1994) Water-Repellent Preservative Non-Pressure Treatment for Millwork

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Doors shall be of the type, size, and design indicated on the drawings, and shall be the standard products of manufacturers regularly engaged in the manufacture of wood doors.

1.2.2 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door. The identifying mark or a separate certification shall include identification of the standard on which construction of the door is based, identity of the manufacturing plant, identification of the standard under which preservative treatment, if used, was made, and identification of the doors having a Type I glue bond.

1.3 SUBMITTALS

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

SD-04 Drawings\

Wood Doors\; *FIO*\.

Drawings indicating the location of each door, elevation of each type of door, details of construction, marks to be used to identify the doors, and location and extent of hardware blocking. Drawings shall include catalog cuts or descriptive data for doors, weatherstripping, flashing, and thresholds to be used.

SD-06 Instructions\

Fire Doors\; *FIO*\.

Manufacturers preprinted installation and touch-up instructions.

SD-13 Certificates\

Adhesives\; *FIO*\.

Certificates for oversize fire doors and/or door/frame assemblies stating that the doors are identical in design, materials, and construction to a door that has been tested and

meets the requirements for the class indicated. Certificate stating that adhesives used for proposed doors do not contain any formaldehyde.

SD-14 Samples\

Wood Doors\; *FIO*\.

Factory Coated Natural Finish\; *FIO*\.

Samples of factory applied natural finish.

1.4 STORAGE

Doors shall be stored in fully covered areas and protected from damage and from extremes in temperature and humidity. Doors shall be stored on supports to prevent warping or twisting, and to provide ventilation. Factory cartons or wrappers shall be kept intact until installation.

1.5 HARDWARE

Hardware, including weatherstripping and thresholds, is specified in Section \=08700=\ BUILDERS' HARDWARE.

1.6 GLAZING

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

1.7 WARRANTY

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

PART 2 PRODUCTS

2.1 GENERAL FABRICATION REQUIREMENTS

2.1.1 Edge Sealing

Wood end-grain exposed at edges of doors shall be sealed prior to shipment.

2.1.2 Preservative Treatment

Exterior softwood doors shall be water-repellent preservative treated in accordance with \-NWWDA I.S. 4-\.

2.1.3 Adhesives

Adhesives shall be in accordance with \-NWWDA I.S. 1-A-\, requirements for Type I Bond Doors (waterproof) for exterior doors and requirements for Type II Bond Doors (water-repellent) for interior doors. Adhesive for doors to receive a transparent finish shall be nonstaining. Adhesives shall contain no formaldehydes.

2.1.4 Prefitting

Doors shall be furnished prefitted in accordance with the standards under which they are produced.

2.2 FLUSH DOORS

Flush doors shall be solid core and shall conform to \-NWWDA I.S. 1-A-\, except for the one year acclimatization requirement in paragraph T-2, which shall not apply. Stiles and rails shall be hardwood; stiles shall be a minimum of 1 1/4" wide; top rail shall be sized to provide reinforcement for door mounted closer hardware (if any). Wood doors shall be 5-ply construction with faces, stiles, and rails bonded to the cores.

2.2.1 Core Construction

2.2.1.1 Solid Cores

Door construction shall be particle board corewith vertical and horizontal edges bonded to the core.

2.2.2 Face Panels

2.2.2.1 Natural Finished Wood Veneer Doors
[AM#1]
Veneer doors to receive natural finish shall be <u>premium grade red oak veneer</u> in accordance with \-NWWDA I.S. 1-A-\. Vertical stile strips shall be selected to provide edges of the same species and/or color as the face veneer. Door finish shall be in accordance with paragraph FINISHING.

2.2.2.2 Hardboard Face
[AM#1]

Hardboard face panels shall be in accordance with \-AHA 135.4-\. Hardboard face panels shall be composed of 1/8 inch thick tempered hardboard. Panels shall be flush panel interior grade design as shown. Vertical stiles shall be _____ _____ hardwood. Doors shall be furnished prefinished in accordance with paragraph FINISHING.

2.2.3 Reinforcement Blocking

Fire rated doors shall be provided, as required, with hardware reinforcement blocking, and top, bottom, and intermediate rail blocking. Lock blocks shall be manufacturer's standard Reinforcement blocking shall be in compliance with the manufacturer's labeling requirements. Reinforcement blocking shall not be of mineral material.

2.2.4 Stile Edges

Composite fire rated doors shall be provided with vertical stile edges that do not contain fire retardant salts.Vertical stiles shall be of the same species and/or color as the face veneer.

2.3 FINISHING

2.3.1 *Factory Coated Natural Finish*\

[am#1]

Doors indicated to receive factory coated natural finish shall be given a transparent finish conforming to \-AWI-02-\, Section 1500, Premium Grade, lightstain, dull rubbed sheen, open grain effect. Finish shall be AWI factory finish system Number TR3 or TR4. Color of the natural finish shall be in accordance with Section \=09900=\ BUILDING COLOR AND FINISH SCHEDULE. Edges of unfitted doors shall be field finished after fitting to the frames.

PART 3 EXECUTION

3.1 INSTALLATION OF DOORS

3.1.1 General Use Doors

Doors shall be provided with steel door frame assemblies, refer to 8110; section Steel Door & Frames for door frames. Doors shall be fit, hung, and trimmed as required. Door shall have a clearance of 1/8 inch at the sides and top and shall have a bottom clearance of1/4 inch over thresholds and 1/2 inch at

other locations unless otherwise shown. The lock edge or both edges of doors shall be beveled at the rate of 1/8 inch in 2 inches.Cuts made on the job shall be sealed immediately after cutting, using a clear varnish or sealer. Bottom of doors shall be undercut to allow clear door swing over carpeted areas. Vertical edges of doors which have not been rounded or beveled at the factory shall be eased when the doors are installed.

- - o 0 o - -

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.

2.1.1.1 Non-Insulated Curtains

Curtains shall be formed of interlocking slats of shapes standard with the manufacturer. Slats for exterior doors shall be flat type.

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 <u>off-set</u> 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

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.

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

Steel slats and hoods shall be hot-dip galvanizedG60 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. 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 ABD 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.

- - o 0 o - -

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 yearsof 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]

_____
_____
_____

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.Panel thickness and composition shall be designed to provide an STC rating of not

less than 48in 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.

- - o 0 o - -

SECTION 08520

ALUMINUM WINDOWS

02/94

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

\-AA DAF-45-\	(1980) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

\-AAMA 101-\	(1993) Voluntary Specifications for Aluminum and Poly(Vinyl Chloride) (PVC) Prime Windows and Glass Doors
\-AAMA 603.8-\	(1992) Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum
\-AAMA 605.2-\	(1992; Addenda Feb 1994) Voluntary Specification for High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels
\-AAMA 1503.1-\	(1988) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

	Specified Pressure Differences Across the Specimen
\-ASTM E 330-\	(1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
\-ASTM E 547-\	(1993) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

\-ASME A39.1-\	(1991; A39.1a) Safety Requirements for Window Cleaning

INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

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

SCREEN MANUFACTURERS ASSOCIATION (SMA)

\-SMA 1004-\	(1987) Aluminum Tubular Frame Screens for Windows

1.2 WINDOW PERFORMANCE

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

1.2.1 Structural Performance

Structural test pressures on window units shall be for positive load (inward) and negative load (outward) in accordance with \-ASTM E 330-\. After testing, there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which

could cause window to be inoperable. There shall be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by \-AAMA 101-\ for the window types and classification specified in this section.

1.2.2 Air Infiltration

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

1.2.3 Water Penetration

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

1.2.4 Thermal Performance

Thermal transmittance for thermally broken aluminum windows with insulating glass shall not exceed - K-Value Class 5.678 Btuh/ft2 of when tested in accordance with \-AAMA 1503.1-\.

1.2.5 Life Safety Criteria

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

1.3 SUBMITTALS

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

SD-01 Data\

Aluminum Windows\; *FIO*\.

Manufacturer's descriptive data and catalog cut sheets.

SD-04 Drawings\

Aluminum Windows\; *FIO*\.

Insect Screens\; *FIO*\.

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

SD-06 Instructions\

Aluminum Windows\; *FIO*\.

Manufacturer's preprinted installation instructions and cleaning instructions.

SD-09 Reports\

Aluminum Windows\; *FIO*\.

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

SD-13 Certificates\

Aluminum Windows\; *FIO*\.

Certificates stating that the aluminum windows are AAMA certified conforming to requirements of this section. Labels or markings permanently affixed to the window will be accepted in lieu of certificates.

SD-14 Samples\

Aluminum Windows\; *FIO*\.

Manufacturer's standard color samples of the specified finishes.

1.4 DELIVERY AND STORAGE

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

1.5 WARRANTY

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

PART 2 PRODUCTS

[AM#1]

2.1 Aluminum Window Types

[AM#1]

Aluminum windows shall consist of complete units including sash, glass, frame, _____, and hardware. Windows shall conform to \-AAMA 101-\. Windows shall be double-glazed and shall have a minimum condensation resistance factor of 45 when tested in accordance with \-AAMA 1503.1-\.
_____-

2.1.1 Fixed Windows

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

2.1.2 [AM#1]_____

[AM#1]

_____
_____
_____

2.2 [AM#1]_____

[AM#1]

_____
_____
_____

2.3 [AM#1]_____

[AM#1]

_____
_____
_____
_____

2.4 ACCESSORIES

2.4.1 Fasteners

Fastening devices shall be window manufacturer's standard design made from aluminum, non-magnetic stainless steel, cadmium-plated steel, nickel/chrome-plated steel or magnetic stainless steel in compliance with \-AAMA 101-\. Self-tapping sheet metal screws will not be acceptable for material thicker than 1/16 inch.

2.4.2 Hardware

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

2.4.3 [AM#1]_____

[AM#1]

_____

_____

_____

2.5 GLASS AND GLAZING

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

2.6 FINISH

2.6.1 Anodized Aluminum Finish

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

2.6.2 Color

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

PART 3 EXECUTION

3.1 INSTALLATION

Aluminum windows shall be installed in accordance with approved shop drawings and manufacturer's published instructions. Aluminum surfaces in contact with masonry, concrete, wood and dissimilar metals other than stainless steel, zinc, cadmium or small areas of white bronze, shall be protected from direct contact using protective materials recommended by \-AAMA 101-\. The completed window installation shall be watertight in accordance with Section \=07920=\ JOINT SEALING. Glass and glazing shall be installed in accordance with requirements of this section and Section \=08810=\ GLASS AND GLAZING.

3.2 ADJUSTMENTS AND CLEANING

3.2.1 [AM#1]_____

[AM#1]

_____

_____

_____

3.2.2 Cleaning

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

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

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 All5-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 will be fitted to the sample lockest. 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 othere 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 soild 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 lockor 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:	50 total.

The keys shall be furnished to the Contracting Officer arranged in a containerfor 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 1bf~\ applied at the latch stile or exceed \~5 1bf~\ 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 \^50 mm^\ \~2 inches~\ less than door width for single doors and \^25 mm^\ \~1 inch~\ less for pairs of doors. Height shall be \^,^\ \~10 inches,~\ except where the bottom rail is less than \^^\ \~10 inches~\ the plate shall extend to within \^13 mm^\ \~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 TypeJ103 stainless steel. Width of plates shall be \~2 inches~\ less than door width for single doors and \^\ \~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, \~0.050 inch~\ thick minimum stainless steel beveled four edges.

2.9.2.2 Flat Plates

Flat plates shall be Type J301 \~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 \-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 \-BHMA A156.16-\.

2.11 MISCELLANEOUS

2.11.1 Metal Thresholds

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

2.11.2 Rain Drips

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

2.11.3 Key Control Storage System

Key control storage system shall conform to \-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 - Mech. Rm. A101)

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

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

HW-2 (Door no. 1A - Mech. Rm. A101)

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 - Boiler rm. A102)

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 Como. Rm. A103, & Elec. Rm. A104)

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 - Equip. Rm. D119)

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 - Mech. Rm. D120)

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

HW-7 (Door no. 7 - Corr. C101)

	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

HW-8 (Door no. 8 - Vest. E100)

	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

HW-9 (Door no. 9 - Vest. E100)

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

HW-10 (Door no. 10 - Corr. B115, C115, D115)

	2 sets	Pivots,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

HW-11 (Door no. 11 - Vest. B114, C114, D114)

	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

HW-12 (Door no. 12 - Corr. B115, C115, D115)

2 sets	Pivot, C07131 x finish to match door
2 ea.	Exit devices, type 6, function 06 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

HW-13 (Door no. 15 - Toilet-women E104)

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 - Toilet-men)

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 - Jan. Closet E110)

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 - Store rm. B119)

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

HW-17 (Fire rated - 20 min.)(Door 19 - Office B100)

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 - como. rm. B102)

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 no. 22 - storage rm. B103)

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

<u>HW-20</u> (Fire rated - 20 min.)(Door no. 23 - class rms.)

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

- - o 0 o - -

SECTION 08810

GLASS AND GLAZING

05/97

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI Z97.1-\	(1984; R 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 509-\	(1994) Elastomeric Cellular Preformed Gasket and Sealing Material
\-ASTM C 669-\	(1995) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
\-ASTM C 864-\	(1993) Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
\-ASTM C 920-\	(1994) Elastomeric Joint Sealants
\-ASTM C 1036-\	(1991) Flat Glass
\-ASTM C 1048-\	(1992) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
\-ASTM C 1172-\	(1991) Laminated Architectural Flat Glass
\-ASTM C 1349-\	(1996) Architectural Flat Glass Clad Polycarbonate

\-ASTM D 395-\	(1989; R 1994) Rubber Property - Compression Set
\-ASTM E 119-\	(1995a) Fire Tests of Building Construction and Materials
\-ASTM E 773-\	(1988) Seal Durability of Sealed Insulating Glass Units
\-ASTM E 774-\	(1992) Sealed Insulating Glass Units
\-ASTM E 1300-\	(1994) Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

\-ASCE 7-\	(1995) Minimum Design Loads for Buildings and Other Structures

CODE OF FEDERAL REGULATIONS (CFR)

\-16 CFR 1201-\	Safety Standard for Architectural Glazing Materials

COMMERCIAL ITEM DESCRIPTION (CID)

\-CID A-A-378-\	(Basic) Putty: Linseed Oil Type, (for Wood-Sash-Glazing)

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

\-GANA-01-\	(1990) Glazing Manual
\-GANA-04-\	(1995) Engineering Standards Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 80-\	(1995) Fire Doors and Windows
\-NFPA 252-\	(1995) Fire Tests of Door Assemblies
\-NFPA 257-\	(1996) Fire Tests for Window and Glass Block 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\

Glass\; *FIO*\.

Glazing Accessories\; *FIO*\.

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

SD-04 Drawings\

Glazing Materials and Accessories\; *FIO*\.

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

SD-13 Certificates\

Glass\; *FIO*\.

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

SD-14 Samples\

Glass\; *FIO*\.

Two 8 x 10 inch samples of each of the following: tinted glass, and insulating glass units.

1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in accordance with \-ANSI Z97.1-\. Glazed panels shall comply

with indicated wind/snow loading in accordance with \-ASTM E 1300-\.

1.4 DELIVERY, STORAGE AND HANDLING

Glazing compounds shall be delivered to the site in the manufacturer's unopened containers. Glass shall be stored indoors in a safe, well ventilated dry location in accordance with manufacturer's instructions, and shall not be unpacked until needed for installation. Glass shall not be stored on site over 1 month.

1.5 PROJECT/SITE CONDITIONS

Glazing work shall not be started until outdoor temperature is above 40 degrees F and rising, unless procedures recommended by glass manufacturer and approved by Contracting Officer are made to warm the glass and rabbet surfaces. Ventilation shall be provided to prevent condensation of moisture on glazing work during installation. Glazing work shall not be performed during damp or raining weather.

1.6 WARRANTY

1.6.1 Insulating Glass

Manufacturer shall warrant the insulating glass to be free of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal for a period of 10 years from Date of Substantial Completion. Warranty shall be signed by manufacturer.

PART 2 PRODUCTS

2.1 FLOAT GLASS

2.1.1 Clear Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - clear, Quality q3 - glazing select, conforming to \-ASTM C 1036-\.

2.2 INSULATING GLASS

Insulating glass shall be Class A preassembled units of dual-seal construction consisting of lites of glass separated

by an aluminum spacer and dehydrated space conforming to \-ASTM E 773-\ and \-ASTM E 774-\. Glass thickness shall be 1/8 inch per pane with 1/2-inch dehyreated space. Aluminum spacer shall be roll-formed, with bent or tightly soldered joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone. Glass types shall be as follows:

[AM#1]

2.2.1 Clear Insulating Glass, Tempered

Glass for two-pane insulating units shall be FT fully tempered transparent flat type, Class 1 - clear, Quality q3 - glazing select, conforming to \-ASTM C 1036-\. Glass performance shall be \^ U-Value/Winter Nighttime .49 max. Color shall be bronze. Maximum shading coeffieient shall be 0.73. Visable transmittance shall be a maximum of 62%.

[AM#1]

2.2.2 Tinted Insulating Glass, Tempered

Interior and exterior glass panes shall be Type FT fully tempered transparent flat type, Class 2-tinted, Quality q3 - glazing select, conforming with \-ASTM C 1036-\. Glass performance shall be U Value/Winter Nighttime .49 max, shading coefficient 0.73. Color shall be bronze. Visable transmittance shall be a maximum of 62%.

2.3 HEAT-TREATED GLASS

Heat-treated glass shall conform to the following requirements.

2.3.1 Tempered Glass

[AM#1]

Tempered glass shall be kind FT fully tempered transparent flat Class 1-clear and Class 2-tinted, Condition A uncoated surface, Quality q3 - glazing select, 55 percent visable light transmittance, maximum 0.73 percent shading coefficient conforming to \-ASTM C 1048-\ and \-GANA-04-\. Color shall be bronze and located where indicated on the Door and Window Schedules. Thickness shall be 1/4-inch or as required to comply with 16 CFR 1201.

2.4 SPANDREL GLASS

2.4.1 Ceramic-Opacified Spandrel Glass

Ceramic-opacified spandrel glass shall be kind HS heat-strengthened transparent flat type, Condition B, coated with a colored ceramic material on No. 2 surface, Quality q3 - glazing select, conforming to \-ASTM C 1048-\. Glass performance shall be U-Value/Winter Nighttime 1.09, shading coefficient .72. Color shall be bronze.

2.5 GLAZING ACCESSORIES

2.5.1 Preformed Tape

Preformed tape shall be elastomeric rubber extruded into a ribbon of a width and thickness suitable for specific application. Tape shall be of type which will remain resilient, have excellent adhesion, and be chemically compatible to glass, metal, or wood.

2.5.2 Sealant

Sealant shall be elastomeric conforming to \-ASTM C 920-\, Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulating glass. Color of sealant shall match frame.

2.5.3 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

2.5.3.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to \-ASTM C 509-\, Type 2, Option 1.

2.5.3.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to \-ASTM C 864-\, Option 1, Shore A durometer between 65 and 75.

2.5.3.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

2.5.4 Putty and Glazing Compound

Glazing compound shall conform to \-ASTM C 669-\ for face-glazing metal sash. Putty shall be linseed oil type conforming to \-CID A-A-378-\ for face-glazing primed wood sash. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

2.5.5 Setting and Edge Blocking

Neoprene setting blocks shall be dense extruded type conforming to \-ASTM D 395-\, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (+ or - 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

Openings and framing systems scheduled to receive glass shall be examined for compliance with approved shop drawings, \-GANA-01-\ and glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaces and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

3.2 INSTALLATION

Glass and glazing work shall be performed in accordance with approved shop drawings, \-GANA-01-\, glass manufacturer's

instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Wired glass and fire/safety rated glass shall be installed in accordance with \-NFPA 80-\. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

3.3 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

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

Abbreviation	Material	Manufacturer	Mfgr's No/Color
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

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

[AM#1] P-6	Paint	Sherwin Williams	Steeplegray 2131 Gloss
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
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
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, 1lb 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"
Corner Guards	Kenmark Brady Brackin 214-348-8000	Koroseal K-15 Cloud
Exterior Finish System	USG	Sunlite

	972-371-5990	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
Standing Seam Roof	MBCI Charlie Joyner 972-988-3300	Signature 300 Colonial Red
Toilet Partitions Vanities	Santana 1-800-368-5008	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 <u>and Exposed Steel on Stairs</u>

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

	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 CPT-1	P-1	P-1	P-1	P-1	ATC-1

Area: Classroom B,C,D 105,205

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

Area: Classroom B,C,D 106,206

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

Area: Classroom B,C,D 107,207

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

Area: Classroom B,C,D 108,208

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

Area: Classroom B,C,D 109,209

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

Area: Classroom B,C,D 110,210

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

Area: Classroom B,C,D 111,211

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

Area: Classroom B,D 112,212

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

Area: Office C212

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

Area: Classroom B,C,D 113,213

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

Area: Vestibule B,C,D 114

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

Area: Corridor B,C,D 115,215

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

NOTE: Walls defining alcoves to entrances to classrooms shall be P-1. Walls that define corridor shall be P-2

Area: Storage B119

	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 B120

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

Area: Corridor C 101,201

	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		ATC-1

NOTE: See 1.5.13 for quarry tile pattern.

Area: Sprinkler Riser C 103,203

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

Area: Mechanical Rm C112

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

Area: Vault C116

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

Area: Storage C216

	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: Office D 100,200

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

Area: Corridor D 101,201

	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
Matl.:	RB-1	CPT-1	P-2	P1,P2	P-2	P-2	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 W/recessed mat, bordered with QT-1	Brick		Brick		ATC-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 QT-2,QT-3 QT-4,QT-5	P-2	P-2	P-2	P-2	ATC-1

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-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 E105,205

	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 E106,206

	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 E107,207

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

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 QT-2,QT-3, QT-4,QT-5	---	P-2	P-2	P-2,VWC-1	ATC-1

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-3 CT-4	CT-2 CT-3 CT-4	CT-2 CT-3 CT-4	CT-2 CT-3 CT-4	P-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 QT-2,QT-3 QT-4,QT-5	P-2	---	P-2	---	ATC-1

See. 1.5.13 for quarry tile pattern.

Area: Storage E212

	Base	Floor	A Wall	B Wall	C Wall	D Wall	Ceiling
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-2	CT-2	CT-2	CT-2	P-4
		CT-5	CT-5	CT-5	CT-5	CT-5	
		CT-6	CT-6	CT-6	CT-6	CT-6	

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	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 F 106,206

	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 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-3 CT-4	CT-2 CT-3 CT-4	CT-2 CT-3 CT-4	CT-2 CT-3 CT-4	P-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 QT-2,QT-3, QT-4,QT-5	P-2	---	P-2	---	ATC-1

See 1.5.13 for quarry tile pattern.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

- - o 0 o - -

SECTION 09250

GYPSUM WALLBOARD

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 580-\	(1995a) Stainless and Heat Resisting Steel Wire
\-ASTM A 853-\	(1993) Steel Wire, Carbon, for General Use
\-ASTM B 164-\	(1993) Nickel-Copper Alloy Rod, Bar, and Wire
\-ASTM C 36-\	(1995) Gypsum Wallboard
\-ASTM C 79-\	(1994) Gypsum Sheathing Board
\-ASTM C 475-\	(1994) Joint Compound and Joint Tape for Finishing Gypsum Board
\-ASTM C 514-\	(1996) Nails for the Application of Gypsum Board
\-ASTM C 557-\	(1993a) Adhesive for Fastening Gypsum Wallboard to Wood Framing
\-ASTM C 630-\	(1996a) Water-Resistant Gypsum Backing Board
\-ASTM C 645-\	(1995) Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board

\-ASTM C 754-\	(1996) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board
\-ASTM C 840-\	(1996) Application and Finishing of Gypsum Board
\-ASTM C 931-\	(1995) Exterior Gypsum Soffit Board
\-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 960-\	(1996) Predecorated Gypsum Board
\-ASTM C 1002-\	(1996a) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases
\-ASTM C 1047-\	(1994) Accessories for Gypsum Wallboard and Gypsum Veneer Base

GYPSUM ASSOCIATION (GA)

\-GA 216-\	(1996) Application and Finishing of Gypsum Board
\-GA 600-\	(1994) Fire Resistance Design Manual

UNDERWRITERS LABORATORIES (UL)

\-UL-05-\	(1997) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

1.2.1 Fire-Rated Construction

Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements, and as required to meet pressurization requirements. Penetrations through rated partitions and ceilings shall be sealed tight in accordance with tested systems. Fire ratings shall be as indicated.

1.3 SUBMITTALS

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

SD-04 Drawings\

Steel Framing\; *FIO*\.

Control Joints\; *FIO*\.

Fire-Resistant Assemblies\; *FIO*\.

Drawings and installation details for ceiling framing, furring, special wall framing, and framed openings in walls and ceilings.

SD-13 Certificates\

Gypsum Wallboard\; *FIO*\.

\ Tile Backer Board*\; *FIO*\.

Exterior Gypsum Soffit Board\; *FIO*\.

Steel Framing\; *FIO*\.

Fire-Rated Gypsum Board\; *FIO*\.

Certificates stating that the steel framing and gypsum wallboard meet the specified requirements.

1.4 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 5 years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 3 years of documented successful experience.

1.5 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered in original containers bearing the name of manufacturer, contents, and brand name. Materials shall be stored off the ground in a weathertight structure for protection. Gypsum boards shall be stacked flat, off floor and supported to prevent sagging and warpage. Adhesives and joint

materials shall be stored in accordance with manufacturer's printed instructions. Damaged or deteriorated materials shall be removed from jobsite.

1.6 ENVIRONMENTAL CONDITIONS

Environmental conditions for application and finishing of gypsum board shall be in accordance with \-ASTM C 840-\. During the application of gypsum board without adhesive, a room temperature of not less than \~40 degrees F~\ shall be maintained. Building spaces shall be ventilated to remove water not required for drying joint treatment materials. Drafts shall be avoided during dry hot weather to prevent materials from drying too rapidly.

PART 2 MATERIALS

2.1 NON-LOADBEARING STUD WALLS

2.1.1 Studs

[AM#1]

Studs for non-loadbearing walls shall conform to \-ASTM C 645-\. Studs shall be C-shaped, roll formed steel with minimum uncoated design thickness of 0.0478 inches (18 gauge) at 16-inches o.c. made from G40 hot-dip galvanized coated sheet.

2.1.2 Runner Tracks

Floor and ceiling runner tracks shall conform to \-ASTM C 645-\. Tracks shall be prefabricated, U-shaped with minimum \~1 inch~\ flanges, unpunched web, thickness to match studs, made from G40 hot-dip galvanized coated sheet.

2.2 SUSPENDED CEILING FRAMING

Carrying channels shall be formed from \~ 0.0598 in~\ thick cold-rolled steel, \~1-1/2 x 3/4 inch.~\ Furring members shall be formed from cold-rolled steel, \~7/8 x 2-9/16 inch.~\ Carrying channels and furring members shall be made from hot-dip galvanized coated sheet.

2.3 GYPSUM BOARD

Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length. Gypsum board thickness shall be as shown.

[AM#1]

2.3.1 Standard Gypsum Board

Regular gypsum board shall conform to \-ASTM C 36-\, and shall be \~48 inches~\ wide.

2.3.2 *Fire-Rated Gypsum Board*

Fire-rated gypsum board shall conform to \-ASTM C 36-\, and shall be Type X or Type C as required, \~48 inches~\ wide.

2.3.3 Tile backer Board

[AM#1]

Tile backer board shall be 5/8 inch thick \, regular, with water-resistant core, fiberglass surface mats front and back with water and vapor retardant coating, paintable surfaces, and shall be \~48 inch~\ width and maximum permissible length.

_____-

2.3.4 Exterior Sheathing Board

[AM#1]

Exterior sheathing board shall conform to \-ASTM C 79-\, Type X, shall have water-resistant core, water-repellant faces each side, with tongue-and-groove edges, and be \~24 inches~\ wide, or square edges and \~48 inches~\ wide with a minimum thickness of 5/8-inches.

[AM#!]

2.3.5 Exterior Cement Board

Exterior cement board shall be a non-combustible exterior grade portland cement product. Board shall be 4 feet by 8 feet with a minimum 5/8-inch thickness. Boards shall consist of an aggregated portland cement core faced on both surfaces and wrapped on long edges with an embedded polymer-coated glass fiber mesh. Bonding surface shall have rough texture. Exterior cement board shall comply with the following requirements:

PROPERTY	TEST METHOD	REQUIREMENT
Flexural Strength	ASTM C 947	750 psi, Min.
Compressive Strength	ASTM D 2394	1250 psi, Min.
Crack Resistance	ASTM E 72	No cracking
Non-combustibility	ASTM E 136	Pass

Flame Spread/Smoke	ASTM E 84	5/0 max.
Water Absorption	ASTM C 948	15% max.
Fastener Pull Resistance	ASTM C 473	120 lb min. (Wet or Dry)

2.4 TRIM, MOLDINGS, AND ACCESSORIES

2.4.1 Taping and Embedding Compound

Taping and embedding compound shall conform to \-ASTM C 475-\. Compound shall be specifically formulated and manufactured for use in embedding tape at wallboard joints and fastener heads, and shall be compatible with tape and substrate.

2.4.2 Finishing or Topping Compound

Finishing or topping compound shall conform to \-ASTM C 475-\. Compound shall be specifically formulated and manufactured for use as a finishing compound for gypsum board.

2.4.3 All-Purpose Compound

All-purpose compound shall be specifically formulated and manufactured to use as a taping and finishing compound, and shall be compatible with tape and substrate.

2.4.4 Joint Tape

Joint tape shall conform to \-ASTM C 475-\ and shall be as recommended by board manufacturer.

2.4.5 Trim, control Joints, Beads, Stops and Nosings

Items used to protect edges, corners, and to provide architectural features shall be in accordance with \-ASTM C 1047-\.

2.5 FASTENERS AND ADHESIVES

2.5.1 Nails

Nails shall conform to \-ASTM C 514-\. Nails shall be hard-drawn low or medium-low carbon steel, suitable for intended use.

2.5.2 Screws

Screws shall conform to \-ASTM C 1002-\. Screws shall be self-drilling and self-tapping steel, Type S for wood or light-gauge steel framing.

2.5.3 Hangers

Suspended ceiling runner channel hangers shall be soft, annealed steel wire not less than No. 8 SWG, conforming to \-ASTM A 853-\.

2.5.4 Wire and Clip Type Fastenings

Tie wire, clips, rings, and other fastenings shall be corrosion-resisting steel conforming to \-ASTM A 580-\, composition 302, 304, or 316, condition A.

2.5.4.1 Tie Wire

Tie wire for constructing partitions and vertical furring, and for lacing shall be not less than No. 18 SWG. Tire wire for other applications shall be not less than No. 16 SWG.

2.5.4.2 Clips

Clips used in lieu of tie wire securing the furring channels to the runner channels in ceiling construction shall be made from strip not less than \1/8 inch~\ thick or shall be hairpin clip, formed of wire not less than \~1/8 inch~\ nominal diameter. Other clips and rings or fasteneings of similar materials shall be equivalent in holding power to that provided by tie wire for the specific application.

PART 3 EXECUTION

3.1 INTERIOR WALL FRAMING

Steel framing and furring members shall be installed in accordance with \-ASTM C 754-\. Members shall be in alignment with spacings not to exceed the maximum spacings indicated on drawings. Runners shall be aligned accurately at the floor and ceiling and securely anchored. Partitions that terminate above suspended ceiling shall be braced with same studs to structure above.

3.1.1 Wall Openings

[AM#1] The framing system shall provide for the installation and anchorage of the required subframes or finish frames for wall openings at doors, pass-through openings, and access panels. Partitions shall be strengthened for rigidity at rough openings of more than \~30 inches~\ wide. Studs at openings shall be doubled. Double studs shall be fastened together with screws and secured to floor and overhead runners. Two studs placed back-to-back shall be used for framing doors.

3.1.2 Wall Control Joints

Control joints for expansion and contraction in the walls shall be constructed with double studs installed \~1/2 inch~\ apart in interior walls or wall furrings. Control joint spacing shall not exceed \~30 feet.~\ Door frames of less than ceiling height may be used as control joints only if standard control joints extend to ceiling from both corners of top of door frame. Control joints between studs shall be filled with firesafing insulation in fire rated partitions.

[AM#1]

3.1.3 Bracing

Finish wall that terminate above the ceiling shall have studs in that wall at 4 feet on center extend to structure above. At second floor, these studs at 4 feet on center shall terminate 16 feet above the floor and then diagonally braced to the structure above.

3.2 SUSPENDED CEILING FRAMING

Suspended ceiling system framing shall be installed in accordance with \-ASTM C 754-\.

3.2.1 Hangers

Hangers shall be spaced not more than \~48 inches~\ along runner channels and \~36 inches~\ in the other direction or \~42 inches~\ in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other work. Hangers at ends of runner channels shall be located not more than \~6 inches~\ from wall. Hanger wire shall be looped

around bottom chord of open-web steel joists, or secured to structural elements with suitable fasteners. Sags or twists which develop in the suspended system shall be adjusted. Damaged or faulty parts shall be replaced.

3.2.2 Main Runners

Main runner channels shall be installed in accordance with \-ASTM C 754-\. Hanger wires shall be double strand saddle-tied to runner channels and the ends of hanger wire shall be twisted three times around itself. Main runners shall be located to within \~6 inches~\ of the paralleling wall to support the ends of cross furring. Main runners shall not come in contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped \~12 inches~\ with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around the channels.

3.2.3 Furring Channels

Furring channels shall be spaced in accordance with \-ASTM C 754-\. Furring channels shall be secured to the runner channels and to structural supports at each crossing with tie wire, hairpin clips, or equivalent fastenings. Furring channels shall be located within \~2 inches~\ of parallel walls and beams, and shall be cut \~1/2 inch~\ short of abutting walls.

3.2.4 Ceiling Openings

Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than \~1-1/2 inch~\ main runner channels and vertically installed suspension wires or straps shall be located to provide at least the minimum support specified herein for furring and wallboard attachment. Intermediate structural members not a part of the structural system, shall be provided for attachment or suspension of support members.

3.2.5 Light Fixtures

Light fixtures shall not be supported directly from suspended ceiling runners. Hanger wires for recessed or surface mounted light fixtures shall be anchored to structure at four corners

of light fixtures, and additional wires shall be provided at appropriate locations to carry the weight of light fixtures.

3.2.6 Control Joints

Ceiling control joints for expansion and contraction shall be located where indicated on drawings. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

3.2.6.1 Interior Ceilings With Perimeter Relief

Control joints shall be installed so that linear dimensions between control joints shall not exceed \~50 feet~\ in either direction nor more than \~2500 square feet.~\

3.2.6.2 Interior Ceilings Without Perimeter Relief

Control joints shall be installed so that linear dimensions between control joints shall not exceed 30 feet in either direction nor more than 900 square feet.

3.3 APPLICATION OF GYPSUM BOARD

Gypsum board shall be installed in accordance with \-ASTM C 840-\ and \-GA 216-\ and as specified. Edges and ends of gypsum boards shall be cut to obtain neat fitting joints. End joints of adjoining boards shall be staggered, and shall be staggered on opposite sides of wall. Boards shall be applied with moderate contact without forcing in place. Holes for pipes, fixtures or other small openings shall be cut with a tool which will provide a neat fit. Screws shall be driven so that the heads are slightly below the plane of paper face. Fracturing the paper face or damaging the core shall be avoided. Trim shall be installed at external and internal angles formed by the intersecting gypsum board surfaces with other surfaces. Corner beads shall be installed to vertical and horizontal corners in accordance with manufacturer's published instructions.

3.3.1 Tile Backer Board

Tile backer board shall be installed per manufacturers written instruction for ceiling and walls.

3.3.2 Exterior Gypsum Sheathing

Exterior gypsum sheathing shall be flashed at openings so that water intrusion will not contact the sheathing. Vertical end and edge joints shall abut over the centers of framing members and shall be offset a minimum of one framing space between adjacent rows of gypsum sheathing. Sheathing shall be installed in accordance with manufacturer's instructions.

[AM#1]

3.3.3 Exterior Cement Board

Exterior cement board shall be attached to metal studs with self-tapping wafer-head, corrosion resistant screws. Screws and nails for application of the board shall be spaced not more than 8 inches on each supporting member. Edges and ends of boards shall be butted snugly with vertical joints staggered, and joints treated with exterior tape as recommended by system manufacturer.

3.4 TRIM, MOLDINGS, AND ACCESSORIES INSTALLATION

Trim, moldings and accessories shall be installed in accordance with \-GA 216-\.

3.5 TAPING AND FINISHING

Gypsum board taping and finishing shall be performed in accordance with \-ASTM C 840-\. Boards shall be kept free of dirt, oil and other foreign matter that could cause a lack of bond. Screw heads, dents, gouges, and cut-outs shall be filled with joint compound and sanded. Accessories at exposed joints, edges, corners, openings, and similar locations shall be taped, floated with joint compound, and sanded to produce surfaces ready for gypsum board finishes.

3.5.1 TILE BACKER

Boards used in ceilings shall be tapped and finished in accordance with manufacturers written instructions.

3.6 *FIRE-RESISTANT ASSEMBLIES*\

Gypsum wallboard construction for fire-rated assemblies shall be in accordance with \-UL-05-\, or \-GA 600-\ for the design number indicated on drawings.

3.7 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum board smooth, uniform in appearance, and ready to receive finish as specified.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

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

\-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

Wall tile shall be installed in accordance with the \-TCA-01-\, method Ws44-98.

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 penatrating 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 Manufacter’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.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

- - o 0 o - -

SECTION 09510

ACOUSTICAL CEILINGS

08/96

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 635-\	(1995) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
\-ASTM C 636-\	(1992) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
\-ASTM E 119-\	(1995a) Fire Tests of Building Construction and Materials
\-ASTM E 1264-\	(1990) Standard Classification for Acoustical Ceiling Products
\-ASTM E 1414-\	(1991a) Standard Test for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.

UNDERWRITERS LABORATORIES (UL)

\-UL-05-\	(1996) Fire Resistance Directory

1.2 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units mechanically mounted on a ceiling suspension system. The unit size, texture, finish, and color shall be as specified. The location and extent of acoustical treatment shall be as shown on the drawings.

1.3 SUBMITTALS

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

SD-01 Data\

Acoustical Ceiling System\; *FIO*\.

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

SD-04 Drawings\

Acoustical Ceiling System\; *FIO*\.

Drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

SD-09 Reports\

Fire Resistive Ceilings\; *FIO*\.

Ceiling Attenuation Class and Test\; *FIO*\.

Reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified [fire endurance] [and] [sound transmission] requirements. Data attesting to conformance of the proposed system to Underwriters Laboratories requirements for the fire endurance rating listed in \-UL-05-\ may be submitted in lieu of test reports.

SD-13 Certificates\

Acoustical Units\; *FIO*\.

Certificate attesting that the mineral based acoustical units furnished for the project contains recycled material and showing an estimated percent of such material.

SD-14 Samples\

Acoustical Units\; *GA*\.

Two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent shall be maintained before, during, and after installation of acoustical units.

1.6 SCHEDULING

Interior finish work such as plastering, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

PART 2 PRODUCTS

2.1 *ACOUSTICAL UNITS*\

Acoustical units shall conform to \-ASTM E 1264-\, Class A, and the following requirements:

2.1.1 Units for Exposed-Grid System A

Type: XII (fiberglass base with membrane-faced overlay).
Minimum NRC: .85 when tested on mounting No. 7
Pattern: G.
Nominal size: 24 by 24 inches.
Edge detail: Bold Revealed Painted Edge.
Finish: Factory-applied standard finish.
Minimum LR coefficient: 1.
Minimum CAC: 20.

2.2 SUSPENSION SYSTEM

Suspension system shall be exposed-grid and shall conform to \-ASTM C 635-\ for intermediate-duty systems Surfaces exposed to view shall be aluminum or steel with a factory-applied white. Wall molding shall have a flange of not less than 15/16 inch. Inside corner caps shall be provided where, due to the configuration of the installation, they are needed to produce a workmanlike appearance.

2.3 HANGERS

Hangers shall be galvanized steel wire. Hangers and attachment shall support a minimum300 pound ultimate vertical load without failure of supporting material or attachment.

2.4 FINISHES

Acoustical units and suspension system members shall have manufacturer's standard textures, patterns and finishes as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

2.5 COLORS AND PATTERNS

Colors and patterns for acoustical units and suspension system components shall be as specified in Section 09000 - BUILDING COLOR AND FINISH SCHEDULE.

2.6 *CEILING ATTENUATION CLASS AND TEST*\

Ceiling attenuation class (CAC) range of acoustical units, when required, shall be determined in accordance with \-ASTM E 1414-\. Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that the ceiling will be installed on the project. System shall be tested with all acoustical units installed.

PART 3 EXECUTION

3.1 INSTALLATION

[AM#1] Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work.

Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb. Ceiling clips are required for the corridors, vestibules and outside mechancial rooms. Refer to mechancial drawings for placement of ceiling clips.

3.1.1 Suspension System

Suspension system shall be installed in accordance with \-ASTM C 636-\ and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

3.1.1.1 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Wall molding shall be provided where ceilings abut vertical surfaces. Wall molding shall be secured not more than 3 inches from ends of each length and not more than 16 inches on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

3.2 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

- - o 0 o - -

SECTION 09650

RESILIENT FLOORING

07/96

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM D 4078-\	(1992) Water Emulsion Floor Polish
\-ASTM E 648-\	(1994a) Critical Radiant Flux of floor-Covering Systems Using a Radiant Heat Energy Source
\-ASTM E 662-\	(1995a) Specific Optical Density of Smoke Generated by Solid Materials
\-ASTM F 1066-\	(1995a) Vinyl Composition Floor Tile
\-ASTM F 1303-\	(1995) Sheet Vinyl Floor Covering with Backing
\-ASTM F 1344-\	(1993) Rubber Floor Tile

FEDERAL SPECIFICATIONS (FS)

\-FS RR-T-650-\	(Rev E) Treads, Metallic and Nonmetallic, Skid Resistant
\-FS SS-T-312-\	(Rev B; Int Am 1; Notice 1) Tile, Floor: Asphalt, Rubber, Vinyl Vinyl-Asbestos

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for

information only. The following shall be submitted in accordance with Section \=01330=\ SUBMITTAL PROCEDURES:

SD-09 Reports\

Resilient Flooring and Accessories\; *FIO*\.

Copies of test reports showing that representative product samples of the flooring proposed for use have been tested by an independent testing laboratory within the past three years or when formulation change occurred and conforms to the requirements specified.

SD-14 Samples\

\ Accessories*\; *GA*\.

Three samples of each indicated color and type of base. Sample size shall be minimum 2-1/2 by 4 inches.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers bearing the manufacturer's name, project identification, and handling instructions. Materials shall be stored in a clean dry area with temperature maintained above 70 degrees F for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations. Materials shall be protected from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 70 degrees F and below 100 degrees F for 2 days before application, during application and 2 days after application. A minimum temperature of 55 degrees F shall be maintained thereafter.

1.5 SCHEDULING

Resilient base application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.6 WARRANTY

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

PART 2 PRODUCTS

2.1 RESILIENT BASE

Base shall be manufacturers standard rubber straight style (installed with carpet). Base shall be 4 inches high and a minimum 1/8 inch thick. Formed corners shall be furnished.

2.2 ADHESIVE

[AM#1]
Adhesive for wall base shall be as recommended by the flooring/base manufacturer.

2.3 MANUFACTURER'S COLOR AND TEXTURE

Color and texture shall be indicated in section 09000 - BUILDING COLOR AND FINISH SCHEDULE.

PART 3 EXECUTION

3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall examine and verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government.

3.2 INSTALLATION OF RESILIENT BASE

Wall base shall be installed with adhesive in accordance with the manufacturer's written instructions. Base joints shall be tight and base shall be even with adjacent resilient flooring. Voids along the top edge of base at masonry walls shall be filled with caulk.

3.3 CLEANING

Immediately upon completion of installation of resilient base in an area, flooring and adjacent surfaces shall be cleaned to remove all surplus adhesive.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 09900

PAINTING, GENERAL

07/92

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

\-ACGIH-02-\	(1996) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 150-\	(1995) Portland Cement
\-ASTM D 3273-\	(1994) Resistance to Growth of Mold on the Surface of Interior Coating in an Environmental Chamber
\-ASTM D 3274-\	(1995) Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation
\-ASTM D 4214-\	(1989) Evaluating the Degree of Chalking of Exterior Paint Films
\-ASTM D 4258-\	(1983; R 1992) Surface Cleaning Concrete for Coating

COMMERCIAL ITEM DESCRIPTIONS (CID)

\-CID A-A-1500-\	(Rev A) Sealer, Surface (Latex Block Filler)
\-CID A-A-1546-\	(Rev A) Rubbing Varnish
\-CID A-A-1632-\	(Basic) Varnish, Asphalt
\-CID A-A-1788-\	(Basic) Varnish, Oil: Interior
\-CID A-A-2246-\	(Rev A) Paint, Latex (Gloss, Interior)
\-CID A-A-2336-\	(Basic) Primer Coating (Oil-Alkyd, Exterior Wood, White and Tints)
\-CID A-A-2339-\	(Basic) Stain (Wood, Solvent-Dye Type)

\-CID A-A-2542-\	(Basic) Sealer, Terrazzo and Concrete Floors, Waterbased.
\-CID A-A-2834-\	(Rev A) Urethane, Waterborne (Low VOC, Clear)
\-CID A-A-2867-\	(Basic) Coating, Polyurethane, Single Component Moisture Cure, Alipathic
\-CID A-A-2962-\	(Basic) Enamel, Alkyd
\-CID A-A-2994-\	(Basic) Primer Coating, Interior, for Walls and Wood

FEDERAL SPECIFICATIONS (FS)

\-FS TT-C-555-\	(Rev B; Am 1) Coating, Textured (for Interior and Exterior Masonry Surfaces)
\-FS TT-E-2784-\	(Rev A; Am 1) Enamel (Acrylic-Emulsion, Exterior Gloss and Semigloss)
\-FS TT-P-28-\	(Rev G) Paint, Aluminum, Heat Resisting (1200 Degrees F.)
\-FS TT-S-708-\	(Rev A; Am 2) Stain, Oil; Semi-Transparent, Wood, Exterior
\-FS TT-S-001992-\	(Basic) Stain, Latex, Exterior for Wood Surfaces

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

\-SSPC Paint 5-\	(1995) Zinc Dust, Zinc Oxide and Phenolic Varnish Paint
\-SSPC Paint 18-\	(1991) Chlorinated Rubber Intermediate Coat Paint
\-SSPC Paint 23-\	(1982) latex Primer for Steel surfaces
\-SSPC Paint 25-\	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)
\-SSPC SP 1-\	(1982) Solvent Cleaning
\-SSPC SP 2-\	(1995) Hand Tool Cleaning
\-SSPC SP 3-\	(1995) Power Tool Cleaning
\-SSPC SP 7-\	(1994) Brush-Off Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The

following shall be submitted in accordance with Section \=01330=\ SUBMITTAL PROCEDURES:

SD-01 Data\

Paint\; *FIO*\.

The names, quantity represented, and intended use for the proprietary brands of materials proposed to be substituted for the specified materials when the required quantity of a particular batch is 50 gallons.

SD-06 Instructions\

Mixing and Thinning\; *FIO*\.

Application\; *FIO*\.

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings. Detailed application instructions for textured coatings shall be provided.

SD-09 Reports\

Paint\; *FIO*\.

A statement as to the quantity represented and the intended use, plus the following test report for batches in excess of 50 gallons:

a. A test report showing that the proposed batch to be used meets all specification requirements, or:

b. A test report showing that a previous batch of the same formulation as the batch to be used met all specification requirements, plus, on the proposed batch to be used, a report of test results for properties of weight per gallon, viscosity, fineness of grind, drying time, color, and gloss.

SD-13 Certificates\

Lead\; *FIO*\.

Mildewcide and Insecticide\; *FIO*\.

Volatile Organic Compound (VOC) Content\; *FIO*\.

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead by weight of the total nonvolatile. Certificate stating that paints proposed for use meet Federal VOC regulations and those of the of the local Air Pollution Control Districts having jurisdiction over the geographical area in which the project is located.

SD-14 Samples\

Moisture-curing Polyurethane\; *FIO*\.

A complete moisture-curing polyurethane system applied to a panel of the same material as that on which the coating will be applied in the work and for each color specified. The sample panels will be used for quality control in applying the system.

Paint\; *GA*\.

While the material is at the site or source of supply, and at a time agreeable to the Contractor and the Contracting Officer, a 1 quartsample of each color and batch, except for quantities of 50 gallons or less, shall be taken by random selection from the sealed containers by the Contractor in the presence of a representative of the Contracting Officer. The contents of the containers to be sampled shall be thoroughly mixed to ensure that the sample is representative. Samples shall be identified by designated name, specification number, manufacturer name and address, batch number, project contract number, intended use, and quantity involved.

1.3 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 40 and 95 degrees F. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

1.4 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports furnished, samples will be retained by the Government for testing should the materials appear defective during or after application. In addition to any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 45 and 95 degrees F when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings. Water-thinned coatings shall be applied only when ambient temperature is between 50 and 90 degrees F. Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

1.6 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.6.1 Worker Exposures

Exposure of workers to hazardous chemical substances shall not exceed limits as established by \-ACGIH-02-\, or as required by a more stringent applicable regulation.

1.6.2 Toxic Compounds

Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless approved by the Contracting Officer.

1.6.3 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material data safety sheets (MSDS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

1.6.4 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from preparation, painting and clean-up operations.

PART 2 PRODUCTS

2.1 *PAINT*\

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform to the respective specifications listed for use in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 50 gallons or less, an approved first-line proprietary paint material with similar intended formulation, usage and color to that specified may be used, an approved proprietary paint material may be used. The proprietary paint material shall be of the same type, color, and be equivalent in performance of the type specified in the painting schedules. Equivalent performance shall be within 10 percent of the values for the percent of pigment, the percent of solid content (percent of pigment by weight and the percent of nonvolatile vehicle by weight), the viscosity (in K.U.’s), the gloss, and the drying times for

set-to-touch, recoating, and dry hard. Additional requirements are as follows:

2.1.1 Colors and Tints

Colors shall be as selected from manufacturer's standard colors, as indicated in Specification Section 09000; BUILDING COLOR AND FINISH SCHEDULE. Manufacturer's standard color is for identification of color only. Tinting of epoxy and urethane paints shall be done by the manufacturer. Stains shall conform in shade to manufacturer's standard color. The color of the undercoats shall vary slightly from the color of the next coat.

2.1.2 *Mildewcide and Insecticide*

Paint specified for all coats applied to fabrics and vapor barrier jackets over insulation shall contain a mildewcide that will not adversely affect the color, texture, or durability of the coating. The mildewcide shall be incorporated into the paint by the manufacturer and shall attain a surface disfigurement rating of 8 or greater when tested in accordance with \-ASTM D 3273-\ and evaluated in accordance with \-ASTM D 3274-\. Mercurial mildewcide shall not be used in interior paint. Insecticides shall not be used in paint.

2.1.3 *Lead*

Paints containing lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal) shall not be used.

2.1.4 Chromium

Paints containing zinc chromate or strontium chromate pigments shall not be used.

2.1.5 *Volatile Organic Compound (VOC) Content*

Paints shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority. When the materials specified in the painting schedule do not meet the applicable VOC content limitations, the Contractor shall notify the Contracting Officer prior to commencing the work, informing the contracting Officer of proposed substitute materials. Substitute materials may be proprietary paint materials of the same type, color, and which are equivalent in performance of the types specified in the painting schedule and which meet the VOC content requirements. Equivalent performance shall be as defined in PART 2 paragraph “PAINT” Coatings shall have the date of manufacture clearly marked on each container.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced

when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed with clean cloths and cleaning solvents prior to mechanical cleaning. Cleaning solvents shall be of low toxicity with a flashpoint in excess of 38 degrees C. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primmed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.2.1 Concrete, Exterior Finish System (EFS) and Masonry Surfaces

Concrete, exterior finish system (EFS) and masonry surfaces shall be allowed to dry at least 30 days before painting, except concrete slab on grade which shall be allowed to cure 90 days before painting. Surfaces shall be cleaned in accordance with \-ASTM D 4258-\. Glaze, efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting. Surfaces to receive polyurethane or epoxy coatings shall be acid-etched or mechanically abraded as specified by the coating manufacturer, rinsed with water, allowed to dry, and treated with the manufacturer's recommended conditioner prior to application of the first coat.

3.2.2 Ferrous Surfaces

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned or detergent-washed in accordance with \-SSPC SP 1-\. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to \-SSPC SP 2-\, power tools according to \-SSPC SP 3-\ or by sandblasting according to \-SSPC SP 7-\. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

3.2.3 Nonferrous Metallic Surfaces

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned or detergent-washed in accordance with \-SSPC SP 1-\.

3.2.4 Gypsum Board Surfaces

Gypsum board surfaces shall be dry and shall have all loose dirt and dust removed by brushing with a soft brush, rubbing with a cloth, or vacuum-cleaning prior to application of the first-coat material. A damp cloth or sponge may be used if paint will be water-based.

3.2.5 Mastic-Type Surfaces

Mastic-type surfaces shall be prepared by removing foreign material.

3.2.6 Wood Surfaces

Wood surfaces shall be cleaned of foreign matter. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter, unless otherwise authorized. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints. Small, dry seasoned knots shall be scraped, cleaned, and given a thin coat of commercial knot sealer, before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or, if it is still soft, removed with mineral spirits or turpentine, and the resinous area shall be thinly coated with knot sealer. Finishing nails shall be set, and all holes and surface imperfections shall be primed. After priming, holes and imperfections in finish surfaces shall be filled with putty or plastic wood filler, colored to match the finish coat if natural finish is required, allowed to dry, and sanded smooth. Putty or wood filler shall be compatible with subsequent coatings.

3.2.6.1 Interior Wood Stain

Interior wood surfaces to receive stain shall be sanded. Oak and other open-grain wood to receive stain shall be given a coat of wood filler not less than 8 hours before the application of stain; excess filler shall be removed and the surface sanded smooth.

3.2.7 Previously Painted Surfaces

Previously painted surfaces specified to be repainted and/or damaged during construction shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas. Edges of chipped paint shall be feather edged and sanded smooth. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting. Chalk shall be removed so that when tested in accordance with \-ASTM D 4214-\, the chalk resistance rating is no less than 8. New, proposed coatings shall be compatible with existing coatings. If existing surfaces are glossy, the gloss shall be reduced.

3.3 *MIXING AND THINNING*

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.3.1 Cement-Emulsion Filler Coat

Cement and aggregate shall be dry-mixed so that uniform distribution and intermixing are obtained. Mixing liquid and one-half of the total amount of water shall be premixed and added gradually to the white portland cement and aggregate with constant stirring until a thick, smooth material is obtained. Emulsion paint shall then be added to the mixture and stirred until uniformity is obtained. The blend shall have a thick, creamy consistency. The remainder of the water shall be added if necessary to obtain a material with adequate application properties. Blending resin emulsion or emulsion paint with any other component shall be done with caution; too rapid an agitation will cause air entrapment and foaming.

3.3.2 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.4 *APPLICATION*\

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

3.4.1 Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by \-ACGIH-02-\, or as required by a more stringent applicable regulation. Interior work zones having a volume of 10,000 cubic feet or less shall be ventilated at a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried. Adequate ventilation shall be provided during paint application. Adjacent inhabited areas shall be protected by approved precautionary methods.

3.4.2 Respirators

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

3.4.3 First Coat

The first coat on plaster, gypsum wallboard, and other surfaces shall include repeated touching up of suction spots or overall application of primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application. The first coat on both faces of wood doors shall be applied at essentially the same time. Glazed doors and sashes shall be given the specified coating system within 3 weeks of the time they are glazed, but not before the glazing material has set; paint shall overlay glass about 70 mils all around. Each varnish coat shall be sanded lightly prior to application of subsequent coats.

3.4.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

3.4.5 Stains

On smooth exterior wood surfaces such as the planed face of bevel siding, the stain shall be applied at a spreading rate of 400 to 500 square feet per gallon. On rough surfaces such as an unplaned or scarred face of bevel siding, the stain shall be spread at the rate of 200 to 250 square feet per gallon or as recommended by the manufacturer. Oil-type stain shall be applied by brushing with the grain for the full length of the board or course of siding.

3.4.6 Fillers

Concrete and masonry surface voids shall be filled; however, surface irregularities need not be completely filled. The dried filler shall be uniform and free of pinholes. Filler shall not be applied over caulking compound.

3.4.6.1 Cement-Emulsion Filler

Immediately before filler application, surfaces shall be dampened uniformly and thoroughly, with no free surface water visible, by several applications of potable water with a fog spray, allowing time between the sprayings for water to be absorbed. Cement-emulsion filler shall be scrubbed into the surface vigorously with a stiff-bristled brush having tampico or palmyra bristles not longer than 2-1/2 inches. At least 24 hours shall elapse before applying exterior emulsion paint over cement-emulsion filler. When the ambient temperature is over 85 degrees F, cement-emulsion filler surfaces shall be dampened lightly with a fog spray of potable water immediately prior to application of the subsequent paint coat.

3.4.6.2 Latex Filler

Latex filler, \-CID A-A-1500-\, shall be applied according to the manufacturer's instructions. Surface voids shall be filled. The filler shall be allowed to dry the length of time specified by the manufacturer prior to applying successive coats of paint. Two coats may be necessary to cover.

3.4.7 Textured Coating

Application of textured coating, \-FS TT-C-555-\, shall be as specified in the manufacturer's printed directions at a rate of 45 to 55 square feet per gallon in one coat.

3.4.8 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

3.5 PIPE COLOR CODE MARKING

Pipes in exposed areas and in accessible pipe spaces shall be provided with color band and titles adjacent to all valves, except those provided at plumbing fixtures, at not more than 40 foot spacing on straight pipe runs, adjacent to change in direction, and on both sides where pipes pass through walls or floors. Color code marking shall be of the color listed in TABLE I and the size listed in TABLE II. The arrows shall be installed adjacent to each band to indicate the direction of flow in the pipe. The legends shall be printed in upper-case black letters as listed in TABLE I. Letter sizes shall be as listed in TABLE II. Marking shall be painted or applied using colored, pressure-sensitive adhesive markers of standard manufacture. Paint shall be as specified for insulated and uninsulated piping.

Uninsulated pipes in the mechanical rooms shall be painted and labeled. Pipe paint color shall be the color indicated on the “Band” column of Table I. Pipe labels and arrows shall be as indicated in Table I. Uninsulated stainless steel and plastic piping shall not be painted, but shall be color coded in accordance with Table I. Insulated pipe with PVC insulation jacket cover need not be painted, but shall be color coded in accordance with Table I.

Concrete equipment pads in the mechanical rooms shall be touched-up as necessary, after equipment installation. Color of the equipment pad shall be grey.

TABLE I. COLOR CODES FOR MARKING PIPE

Material	Band	Letters and Arrow*	Legend
Cold water (potable)	Green	White	POTABLE WATER
Fire protection water	Red	White	FIRE PR. WATER
Hot water (domestic)	Green	White	H.W.
Hot water recirculating (domestic) [AM#1] [AM#1] [AM#1]	Green	White	H.W.R.
Low temp. water supply (heating)	Yellow	Black	L.T.W.S.
Low temp. water return (heating)	Yellow	Black	L.T.W.R.
Condenser water supply	Green	White	COND. W.S.
Condenser water return	Green	White	COND. W.R.
Chilled water supply	Green	White	C.H.W.S.
Chilled water return	Green	White	C.H.W.R.
Treated water	Yellow	Black	TR. WATER
Chemical feed	Yellow	Black	CH. FEED
Compressed air	Yellow	Black	COMP. AIR
Natural gas	Blue	White	NAT. GAS
[AM#1] Coldwater (non-potable) [AM#1] [AM#1] [AM#1]	Yellow	Black	NON-POTABLE

\~ TABLE II. COLOR CODE MARKING SIZE

Outside Diameter of Pipe Covering (Inches)	Length of Color Band (inches)	Arrow Length x Width (Inches)	Size of Legend Letters and Numerals (Inches)
Less than 1-1/2	8	8 x 2-1/4	1/2
1-1/2 to 2-3/8	8	8 x 2-1/4	3/4
2-1/2 to 7-7/8	12	8 x 2-1/4	1-1/4
8 to 10	24	12 x 4-1/2	2-1/2
Over 10	32	12 x 4-1/2	3-1/2~\

3.6 MISCELLANEOUS PAINTING

3.6.1 Lettering

Lettering shall be provided as scheduled on the drawings, shall be block type, and shall be black enamel. Samples shall be approved before application.

3.7 SURFACES TO BE PAINTED

Surfaces listed in the painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled.

3.8 SURFACES NOT TO BE PAINTED

Surfaces in the following areas are not to be painted:

(a) Exterior poured concrete.
(b) Concrete floors.
(c) Exterior and interior aluminum.
(d) Aluminum or galvanized roofing.
(e) Exterior caulking and sealants.
(f) Door and window hardware unless specifically specified to be painted in Section 08700 - BUILDERS HARDWARE
(g) Sprinkler heads and other fire detection elements.
(h) Safety nosings.
(i) Interior and exterior signs.
(j) Walls and ceilings in crawl spaces.
(k) Aluminum or sized vapor barrier jacketing over insulated pipes in unexposed locations that do not require color coding.

In addition surfaces of hardware, fittings, and other factory finished items shall not be painted.

3.9 CLEANING

Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

3.10 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. Contractor options are indicated by ------or------ between optional systems or coats.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

EXTERIOR PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
Concrete masonry units.	Cement-emulsion filler	\-FS TT-E-2784-\ \- Type III -\	None
	\-CID A-A-1500-\	\-FS TT-E-2784-\ \- Type III -\	None
	\-FS TT-E-2784-\ \- Type III -\	\-FS TT-E-2784-\ \- Typ III -\	None

NOTE: Cement-emulsion filler coat shall be acrylic-based and shall consist of the following ingredients in the proportion stated: white portland cement, \-ASTM C 150-\, Type I, 16.5 pounds; aggregate 33.5 pounds; mixing liquid, factory-prepared acrylic containing 46 to 47 percent solids, 0.75 gallon; potable water 1.0 gallon maximum; exterior emulsion paint, \-FS TT-P-19-\ 1.0 gallon. Aggregate shall consist of Washed silica sand of the following gradation:

U.S. Sieve Size	Percent Sand (by Weight) Passing Individual Sieve
0.850 mm (20)	100
0.600 mm (30)	95 - 100
0.300 mm (50)	30 - 65
0.150 mm (100)	0 - 10
0.075 mm (200)	0 - 1

Wood: stain and varnish finish.	\-FS TT-S-708-\	None	None
	\-FS TT-S-001992-\, Class B	\-FS TT-S-001992-\, Class B	None

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

EXTERIOR PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
Ferrous metal unless otherwise specified.	\-SSPC Paint 25-\	\-FS TT-E-489-\	\-FS TT-E-489-\
Galvanized metal.		\-FS TT-E-2784-\ Type [_____]	\-FS TT-E-2784-\ Type [_____]
Ferrous Metal	\-SSPC Paint 25-\	\-FS TT-E-489-\	None

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

INTERIOR PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
Gypsum board, concrete, and concrete masonry units not requiring a smooth finish, unless otherwise specified	\-CID A-A-2994-\	\-CID A-A-2246-\ Type II	None
Concrete masonry units requiring a smooth finish	\-CID A-A-1500-\	\-CID A-A-2994-\ Type II	\-CID A-A-2246-\
Gypsum board: restrooms unless otherwise specified.	\-CID A-A-2994-\ Type II	\-FS TT-E-2784-\ Type II	None
Ferrous metal unless otherwise specified.	\-SSPC Paint 25-\	\-CID A-A-2962-\ Type I Class Grade C	\-FS TT-E-2962-\ Type I Class Grade C
	\-SSPC Paint 23-\	\-FS TT-E-2784-\ Type I	\-FS TT-E-2784-\ Type I
	\-CID A-A-2867-\	\-CID A-A-2867-\	None
Ferrous metal factory-primed mechanical and electrical equipment.	Two coats of paint as recommended by the equipment manufacturer		None

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

INTERIOR PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
Galvanized metal:	\-FS TT-P-19-\	Two coats of paint to match adjacent areas	
Wood: stain and varnish finishes	Commercially available stain	\-CID A-A-1788-\ \- Type II -\ Class I In addition a fourth coat of \-CID A-A-1788-\ \- Type II -\ Class I	\-CID A-A-1788-\ \- Type II -\ Class I
	CID A-A-2339	\-CID A-A-2834-\ \-Type I Class I-\ In addition a fourth coat of \-CID A-A-2834-\ \-Type I Class I-\	\-CID A-A-2834-\ \-Type I Class I-\
Wood: natural finish	\-CID A-A-1546-\	\-CID A-A-1546-\	\-CID A-A-1546-\
Facing of vapor barrier jackets of presized or adhesive finished cloth over insulation on pipes, ducts, and equipment in following area. [_____]	Two coats of paint to match adjacent areas.		None
Oil-based caulking compound.	\-FS TT-P-38-\	Same as adjacent areas	

- - o 0 o - -

SECTION 10100 - MISCELLANEOUS ITEMS

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.

THE ALUMINUM ASSOCIATION (AA)

\-AA-03-\	(Sep. 1980, 7th Ed.) Designation System for Aluminum Finishes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 543-\	(1981) Slate Blackboards
\-ASTM E 814-\	(1983) Fire Tests of Through-Penetration Fire Stops

PORCELAIN ENAMEL INSTITUTE (PEI)

\-PEI S 100-\	(1965) Architectural Porcelain Enamel on Steel for Exterior Use.

1.2 SUBMITTALS

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

SD-01 Data\

Manufacturer's Catalog Data\; *FIO*\.

SD-04 Drawings\

Fabrication/Erection/Installation Drawings\; *FIO*\.

Drawings shall be submitted for each product listed in PART 2 - PRODUCTS. Drawings shall show sizes, details of construction, method of construction, method of assembling,

hardware materials, colors, method of mounting, location of each item, specifications for surface preparation and installation of items, and all other details pertinent to installation. For each product, drawings shall identify all parts by name and material. Materials fabricated or delivered to the job site before approval of the drawings shall be subject to rejection.

SD-14 Samples\

Presentation Cabinets\; *FIO*\.

Unless otherwise indicated, samples shall be full size, taken from manufacturer's stock, and be complete as required for installation. After approval, samples may be installed in the work provided each sample is clearly identified and its location recorded. Provide one sample(s) of each product listed in PART 2 - PRODUCTS unless otherwise indicated below:

Each type writing and tackboard surface, 6 inches square.

Full-size wall clips or anchoring devices.

Each type of frame, 8 inches long.

Each type of trim and chalk trough, 8 inches long.

Each accessory, full size.

1.3 DELIVERY AND STORAGE

Materials and products shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials and products shall be carefully handled and stored in dry, watertight enclosures.

1.4 FIELD MEASUREMENTS

Field measurements shall be taken prior to the preparation of drawings and fabrication to ensure proper fits.

PART 2 - PRODUCTS

2.1 GENERAL

Supplementary parts necessary to complete each product item shall be included even though such work is not definitely

shown or specified. The Contractor shall furnish to the proper trades all anchors, sockets, or fastenings required for securing items to other construction. Details and specifications of items for which standard products are available are representative guides of requirements for such items. Standard products, generally meeting such requirements, will be accepted, if details of construction and installation are approved by the Contracting Officer.

2.1.1 Metal Thickness

Gages of sheet iron and steel specified are U. S. Standard for sheet and plate. Extruded sections shall be at least 1/8-inch thick, unless otherwise specified or shown on the drawings.

2.1.2 Aluminum Frames

[AM#1]

Aluminum frames, trim, and accessories shall be fabricated of 6063-T5 or T6 extruded aluminum alloy. Corners and connections shall be hairline miter or butt joints. Exposed aluminum surfaces shall have a integrally colored medium bronze satin finish. Satin finish shall be chemically etched medium matte anodic coating, Class II Architectural, 0.4 mil thick, in accordance with \-AA-03-\.

2.2 PRESENTATION CABINETS

Presentation cabinets shall be a hardwood solids and veneer of mahogany. Cabinet size shall be 72-inches wide, 48-inces high and mounted as indicated on the drawings. Presentation cabinets shall be as located on the drawings indicated by “screen”. Presentation cabinets shall feature a porcelain-steel writing surface, cork tackable display surfaces with a flip chart, mounted on inside of right hand door, and a concealed projection screen mounted at the top of the interior of the cabinet.

2.3 TELEVISION WALL MOUNTS

[AM#1]

Televsion wall mounts shall be model TVWY35TXR-BK with VCR 4-BK tray as manufactured by “Bretford Manufacturing, Inc.” (800-521-9614) or approved equal. This is a wall mounted Yoke model to house a 30-35-inch television. Base of tray shall be a minimum of 72-inches above finish floor. TV wall mounts shall be to the left of the presentation cabinets as

located on the drawings (indicated by “screen”). Attachment of assembly shall be as recommended by manufacturer.

2.4 FIRE EXTINGUISHER & CABINETS/MOUNTING BRACKETS

2.4.1 Fire Extinguisher Cabinets (FEC)

[AM#1]

Metal fire extinguisher cabinets shall be furnished and installed where shown on the drawings or specified. Cabinets to be located in fire-rated walls shall be fire-rated type, fabricated in accordance with \-ASTM E 814-\, and shall be listed by an approved testing agency for 1-hour and non-combustible wall systems. The testing agency's seal shall be affixed to each fire-rated cabinet. Cabinets shall be of the recessed type suitable for 10 pound extinguishers. Box and trim shall be of heavy gage rolled steel. Door shall be a rigid frame with full length piano type hinge and double strength (DSA) glass panel. Door and box shall be prime-coated inside <u>and out and field painted with P-4 paint as indicated in Section 09000; BUILDING COLOR AND FINISH SCHEDULE.</u>

2.4.2 Fire Extinguisher Bracket (FE)

Provide a fire extinguisher bracket of 16 gauge steel, red baked enamel with spring type band and retainging clip as located on the drawings.

2.4.3 Fire Extinguisher

Provide a 10 pound ABC multi-purpose dry chemcidal fire extinguisher at locations shown on drawings for all fire extinguisher cabinets and brackets. The extinguisher shall meeet NFPA codes governing fire extinguishers, and shall carry a UL and FM approval.

2.5 PUBLIC TELEPHONE ENCLOSURES

Public Telephone Enclosures shall match style and type of Model 006015/Trim-Line, Phillips, Brooks, and Gladwin. Finish shall be brushed stainless steel exterior with a black molded interior. Interior shall be lighted. The cabinet shall have a narrow depth; 24-inches width by 10-inches depth by 42.75 inches in height. Bottom of enclosure shall be 29.5 inches A.F.F. except for one in area E & F (ea. Floor) shall be mounted 54-inchs to coin slot to meet ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION AND INSTALLATION

Mounting surface preparation and product installation shall be in accordance with the product manufacturer's written recommendations.

3.2 BULLETIN BOARDS

Bulletin boards in presentation cabinets shall be mounted with the top edge not higher than 6'-6" above the floor.

3.3 CLEANING

Following installation, dirty or discolored surfaces of the products shall be cleaned, with the products left free of defects. Products that are damaged or improperly installed shall be removed and reinstalled or replaced with new products as directed.

- - o 0 o - -

SECTION 10160

TOILET PARTITIONS AND VANITY UNITS

08/94

PART 1 GENERAL

1.1 REFERENCES

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

CODE OF FEDERAL REGULATIONS (CFR)

\-36 CFR 1191-\	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

FEDERAL SPECIFICATIONS (FS)

\-FS RR-P-1352-\	(Rev C) Partitions, Toilet, Complete

FEDERAL STANDARDS (FED-STD)

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

1.2 SYSTEM DESCRIPTION

Toilet partition system, including toilet enclosures, room entrance screens, and urinal screens, shall be a complete and usable system of panels, hardware, and support components. The partition system shall be provided by a single manufacturer and shall be a standard product as shown in the most recent catalog data. The partition system shall comply with \-FED-STD 795-\ and \-36 CFR 1191-\ for areas as shown. Color of materials shall be indicated in specification section 09000 - BUILDING COLOR AND FINISH SCHEDULE.

Vanity tops, backsplash, side splashes and skirts shall be a complete and usable system of hardware and support components.

1.3 SUBMITTALS

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

SD-01 Data\

Toilet Partition System\; *FIO*\.

Vanity Unit\; *FIO*\.

Manufacturer's technical data and catalog cuts including installation and cleaning instructions.

SD-04 Drawings\

Toilet Partition System\; *FIO*\.

Vanity Unit\; *FIO*\.

Drawings showing plans, elevations, details of construction, hardware, reinforcing, fittings, mountings, and anchorings.

SD-09, Reports\

Tests\; *FIO*\.

Furnish certified test reports from an approved testing laboratory showing that the solid plastic enclosures, entrance screens, and urinal screens to be furnished on this project comply with the specified requirements.

SD-14 Samples\

Toilet Partition System\; *GA*\.

Vanity Unit\; *GA*\.

Manufacturer's standard color charts and color samples.

1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately

ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling.

1.5 WARRANTY

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

PART 2 PRODUCTS

2.1 TOILET ENCLOSURES

Toilet enclosures shall conform to \-FS RR-P-1352-\, Type I, Style A,Floor Supported. Width, length and height of toilet enclosures shall be as shown. Finish surface of panels shall be solid plastic finish. Panels indicated to receive toilet paper holders or grab bars as specified in Section \=10800=\ TOILET ACCESSORIES shall be reinforced for the reception of the items required. Grab bars shall comply with \-FED-STD 795-\ and \-36 CFR 1191-\.

2.2 VANITY UNIT

Vanity tops, backsplashes, skirts, plastic angle brackets, center supports or end supports shall be a standard 24" wide and mounted per drawings. Finish surface of vanity unit shall be solid plastic finish.

2.3 URINAL SCREENS

Urinal screens shall conform to \-FS RR-P-1352-\, Type III, Style A, floor supported. Finish surface of screens shall be solid plastic finish. Width and height of urinal screens shall be as shown.

2.4 HARDWARE

[AM#1]

Hardware for the toilet partition system and vanity unit shall conform to \-FS RR-P-1352-\ for the specified type and style of partitions. Hardware finish shall be highly resistant to alkalies, urine, and other common toilet room acids. Hardware shall be a standard specified by manufacturer. Hardware shall include a coat hook mounted (5 feet above finish floor)on the interior surface of every door. Mounting heights and locations shall be as indicated on drawings.

2.5 COLORS

Color of finishes for toilet partition system components and vanity unit shall be as specified in Section 09000 - BUILDING COLOR AND FINISH SCHEDULE.

2.6 SOLID PLASTIC PANELS

Solid plastic panels, including doors and pilasters, shall be made of high density polymer resins, or solid phenolic material, with integral color. Exposed finish surfaces shall have a smooth-matte finish and shall be water-resistant, non-absorbent, unaffected by steam and high humidity, warp-resistant, and resistant to staining and marking with pens, pencils, or other writing devices. Surfaces shall be cleanable with a damp cloth and soap or household detergents. Panels hall be not less that 3/4-inch thick and shall meet the following minimum performance criteria:

Property	Standard	Performance
Density	ASTM D 1505	0.96+ g/cc
Tensile Strength	ASTM D 638	4400 psi
Elongation	ASTM D 638	Greater than 600%
Izod Impact	ASTM D 256	7.0 foot-lbs/inch of notch
Tensile Impact	ASTM D 1822	120 foot-lbs/inch
Brittleness Temp	ASTM D 746	Less than -76 degrees C
Hardness	ASTM D 2240	68 Shore D
Flexural Modulus	ASTM D 256	220,000 psi
Flammability Index/ Flame Spread	ASTM E 84	0 to 75 for 1-inch thick material

PART 3 EXECUTION

3.1 INSTALLATION

Toilet partitions shall be installed straight and plumb in accordance with approved manufacturer's instructions with horizontal lines level and rigidly anchored to the supporting construction. Where indicated, anchorage to walls shall be by toggle-bolting. Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work.

Vanity tops, side splashes, backsplashes, skirts support plastic components and hardware shall be in accordance with the manufacturer’s standard recommendations. All parts shall be installed in a substantial manner, straight, level, and plumb. No evidence of drilling, cutting, or patching shall be visible in the finished work.

3.2 ADJUSTING AND CLEANING

Doors shall have a uniform vertical edge clearance of approximately 3/16 inch and shall rest open at approximately 30 degrees when unlatched. Baked enamel finish shall be touched up with the same color of paint that was used for the finish. Toilet partitions shall be cleaned in accordance with approved manufacturer's instructions and shall be protected from damage until accepted.

Surfaces of vanity unit shall be cleaned after installation and left free of imperfections.

- - o 0 o - -

SECTION 10260

CORNER PROTECTION

12/95

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

\-AA DAF-45-\	(1980) Designation System for Aluminum Finishes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 167-\	(1993) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
\-ASTM B 221-\	(1995a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
\-ASTM D 256-\	(1993a) Determining the Pendulum Impact Resistance of Notched Specimens of Plastics
\-ASTM D 635-\	(1991) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
\-ASTM E 84-\	(1995) Surface Burning Characteristics of Building Materials

CODE OF FEDERAL REGULATIONS (CFR)

\-36 CFR 1191-\	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

FEDERAL STANDARDS (FED-STD)

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

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

\-NAAMM-500 Series-\	(1988) Metal Finishes Manual for Architectural and Metal Products

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 80-\	(1992) Fire Doors and Windows

SOCIETY OF AMERICAN AUTOMOTIVE ENGINEERS (SAE)

\-SAE J1545-\	(1986) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Color Trim

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\

Corner Guards\; *FIO*\.

[AM#1]_____

[AM#1]_____

[AM#1]_____

Manufacturer's descriptive data, catalog cuts, installation instructions, and recommended cleaning instructions.

SD-04 Drawings\

Corner Guards\; *FIO*\.

Drawings indicating locations and typical elevations of each type of item. Drawings shall show vertical and horizontal

dimensions, full size sections, thickness of materials, and fastening details.

SD-13 Certificates\

Corner Guards\; *FIO*\.

[AM#1]_____

[AM#1]_____

[AM#1]_____

Statements attesting that the items comply with specified fire and safety code requirements.

SD-14 Samples\

Finish\; *GA*\.

Manufacturer's standard samples indicating color and texture of materials requiring color and finish selection.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Materials shall be kept dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 70 degrees F for at least 48 hours prior to installation.

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 GENERAL

To the maximum extent possible, corner guards shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

2.1.1 Resilient Material

Resilient material shall consist of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic and shall conform to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance shall be \^960.8 N.m/m (18 ft. lb/sq. inch)^\ \~18 ft. lbs/sq. inch~\ when tested in accordance with \-ASTM D 256-\, (Izod impact, ft. lbs per sq inch notched).

2.1.1.2 Fire Rating

[AM#1]

Fire rating shall be Class 1 when tested in accordance with \-ASTM E 84-\, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with \-ASTM D 635-\. Material shall be labeled and tested by an approved nationally known testing laboratory.

_____
_____
_____
_____
_____

2.1.1.3 Integral Color

Colored components shall have integral color and shall be matched in accordance with \-SAE J1545-\ to within plus or minus 1.0 on the CIE-LCH scales.

2.2 *CORNER GUARDS*

2.2.1 Resilient Corner Guards

[AM#1]

Corner guard units shall be flush mounted type, radius formed to profile shown. Corner guards shall extend from floor to <u>a minimum of 3-inches above the</u> ceiling. Mounting hardware, cushions, and base plates shall be furnished. Assembly shall consist of a snap-on corner guard formed from high impact resistant resilient material, minimum \^1.98 mm^\ \~0.078 inch~\ thick, mounted on a continuous aluminum retainer. Extruded aluminum retainer shall conform to \-ASTM B 221-\, alloy 6063, temper T5 or T6. Flush mounted type guards shall act as a stop for adjacent wall finish material. Factory fabricated end closure caps shall be furnished for top and

bottom of surface mounted corner guards. Flush mounted corner guards installed in fire rated wall shall maintain the rating of the wall. Insulating materials that are an integral part of the corner guard system shall be provided by the manufacturer of the corner guard system. Exposed metal portions of fire rated assemblies shall have a paintable surface.

2.3 TRIM, FASTENERS AND ANCHORS

Vinyl trim, fasteners and anchors shall be provided for each specific installation as shown.

2.4 *FINISH*\

2.4.1 Aluminum Finish
[AM#1]

Finish for exposed aluminum shall be medium bronze. Concealed aluminum shall be mill finish.

2.4.2 Resilient Material Finish
[AM#1]
Finish for resilient material shall be velour texture with colors as indicated in 09900 BUILDING COLOR AND FINISH SCHEDULE.

2.5 ADHESIVES

Adhesive for resilient material shall be in accordance with manufacturers recommendations.

2.6 COLOR

Color shall be in accordance with Section \= 09900=\ BUILDING COLOR AND FINISH SCHEDULE.

PART 3 EXECUTION

3.1 INSTALLATION
[AM#1]
3.1.1 Corner Guards _____

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

[AM#1]_____

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

- - o 0 o - -

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

CEILINGS 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

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 6000.040 inch 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 kN^\ \~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.

3.3 FIRE SAFETY

An automatic detection system shall be installed below the raised floor meeting the requirements of \-NFPA 75-\ paragraph 5-2.1 and shall sound an audible and visual alarm. Air space below the raised floor shall be subdivided into areas not exceeding 10,000 square feet by tight, noncombustible bulkheads. All penetrations for piping and cables shall be sealed to maintain bulkhead properties.

- - o 0 o - -

SECTION 10800

TOILET ACCESSORIES

10/94

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 1036-\	(1991) Flat Glass

COMMERCIAL ITEM DESCRIPTIONS (CID)

\-CID A-A-2380-\	(Basic) Dispenser, Paper Towel
\-CID A-A-2398-\	(Rev B) Curtain, Shower and Window (Metric - SI)

1.2 SUBMITTALS

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

SD-01 Data\

Finishes\; *FIO*\.

Accessory Items\; *FIO*\.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, and operation instructions.

SD-14 Samples\

Finishes\; *GA*\.

Accessory Items\; *FIO*\.

One sample of each accessory proposed for use. Approved samples may be incorporated into the finished work, provided they are identified and their locations noted.

1.3 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area protected from construction damage and vandalism.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided as indicated. Each accessory item shall be complete with the necessary mounting plates, shall be of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall have oval heads, be of tamperproof design and shall be finished to match the accessory.

2.1.2 *Finishes*\

Except where noted otherwise, finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

2.2 *ACCESSORY ITEMS*\

Accessory items shall conform to the requirements specified below.

2.2.1 Grab Bar (GB)

[AM#1]

Grab bar shall be 1-1/4 inches OD Type 304 stainless steel. Grab bar shall be form and length as indicated. Exposed mounting flange shall have set screw mounting holes concealed on the lip of the flange. Grab bar shall have satin finish. Installed bars shall be capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Space between wall and grab bar shall be 1 1/2 inch.

2.2.2 Glass Mirrors MG/PTD/SD

Paper towel dispenser shall conform to \-CID A-A-2380-\, of not less than 0.269 inch Type 304 stainless steel, and shall be recessed mounted with exposed surfaces satin finished. Dispenser shall have a towel compartment and a mirror door and liquid soap dispenser. Locking mechanism shall be tumbler key lock. One piece seamless 22 gauge flange provided with 1/4" return for rigidity. 1/4" float/plate mirror door mounted on a continuous stainless steel piano hinge and provided with a tumbler lock. Door provided with door retainer. Shelf provided with raised front lip. Cabinet is all welded construction.

Glass for mirrors shall be Type I transparent flat type, Class 1-clear. Glazing Quality q1 1/4 inch thick conforming to \-ASTM C 1036-\. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.2.3 Mirror, Tilt (HC/HT/PTD/SD)

Paper towel dispenser shall conform to \-CID A-A-2380-\, of not less than 0.269 inch Type 304 stainless steel, and shall be recessed mounted with exposed surfaces satin finished. Dispenser shall have a towel compartment and a mirror door and liquid soap dispenser. Locking mechanism shall be tumbler key lock. One piece seamless 22 gauge flange provided with 1/4" return for rigidity. 1/4" float/plate mirror door mounted on a continuous stainless steel piano hinge and provided with a tumbler lock. Door provided with door retainer. Shelf provided with raised front lip. Cabinet is all welded construction.

Tilt mirror shall be surface mounted and shall provide full visibility for person in a wheelchair. Mirror shall have fixed tilt, extending at least 4 inches from the wall at the top and tapering to 1 inch at the bottom. Size shall be the drawings. Glass for mirrors shall conform to \-ASTM C 1036-\ and paragraph Glass Mirrors.

2.2.4 Receptacle Units (WR)

Waste receptacle shall be recessed and shall have a capacity of 500 sheets of C-fold, single-fold, or quarter-fold towel. Waste receptacle shall be designed to be locked in unit and removable for service. Locking mechanism shall be tumbler key lock. Waste receptacle shall have a capacity 12 gallons. Unit shall be fabricated of not less than 0.30 inch stainless steel welded construction with all exposed surfaces having a satin finish. Waste receptacle that accepts reusable liner standard for unit manufacturer shall be provided.

2.2.5 Sanitary Napkin Disposer (SND)

Sanitary napkin disposal shall be constructed of Type 304 stainless steel with removable leak-proof receptacle for disposable liners. Fifty disposable liners of the type standard with the manufacturer shall be provided. Receptacle shall be retained in cabinet by tumbler lock. Disposer shall be provided with a door for inserting disposed napkins, and shall be partition mounted, double access.

2.2.6 COAT HOLDER(CH)

Coat holder shall be concealed surface mounted single coat holder hook. Holder shall be type 304 stainless steel satin finish.

2.2.7 MOP HOLDER (MH)

Mop holder shall be surface mounted fabricated of 18 gauge type 304 satin finish stainless steel. Mop holder consist of 4 holders, spring activated rubber cams on plated steel retainers.

2.2.8 Toilet Tissue Dispenser (TTD)

Unit fabricated of 18 and 22 gauge type 304 stainless steel with exposed surfaces satin finished. Extra toilet tissue roll automatically drops in place after bottom roll is used up. Doors attached with heavy duty rivets and is fitted with tumbler locks. One piece seamless flange is provided with 1/4" return for rigidity, and mounting holes for easy installation

[AM#1]
2.2.9 Seat Cover Dispenser (SCD)

Seat cover dispensers shall be stainless steel and be partition mounted. Dispenser shall have a minimum capacity of 500 seat covers.

[AM#1]
2.2.10 Baby Changing Station (BCS)

Baby changing station shall be wall mounted and shall be fabricated of high impact plastic with no sharp edges. Unit fold down platform shall be concave to the child’s shape, equipped with nylon and velcro safety straps and engineered to withstand static load of 340 lbs. Unit shall have an integral dispenser for sanitary liners.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet accessories shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions. Accessories shall be protected from damage from the time of installation until acceptance.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

- - o 0 o - -

SECTION 12520

WINDOW TREATMENTS

12/96

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.

FEDERAL SPECIFICATIONS (FS)

\-FS AA-V-00200-\	(Rev B) Venetian Blinds

NATIONAL FIRE PROTECTION (NFPA)

\-NFPA 701-\	(1996) Methods of Fire Test for Flame-Resistant Textiles and Films

1.2 GENERAL

Window treatment shall be provided, complete with necessary brackets, fittings, and hardware. Each window treatment type shall be a complete unit provided in accordance with paragraph WINDOW TREATMENT PLACEMENT SCHEDULE. Equipment shall be mounted and operated as indicated. Windows to receive a treatment shall be completely covered. The Contractor shall take measurements at the building and shall be responsible for the proper fitting and hanging of the equipment.

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\

Window Treatments and Hardware\; *FIO*\.

Manufacturer's data composed of catalog cuts, brochures, product information, and maintenance instructions.

SD-04 Drawings\

Window Treatments and Hardware\; *FIO*\.

Drawings showing fabrication and installation details. Drawings shall show layout and locations of track, direction of draw, mounting heights, and details.

SD-14 Samples\

Window Treatments and Hardware\; *GA*\.

Three samples of each type and color of window treatment.

1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling. Materials shall be stored flat in a clean dry area with temperature maintained above 50 degrees F.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 WARRANTY

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

PART 2 PRODUCTS

2.1 WINDOW SHADES

2.1.1 Light Filtering Shades

Light filtering shades shall conform to the following: Roller tube shall be steel and shall operate by clutch and bead operation mechanism. Fascia mounting brackets shall be steel to support roller tube and fascia panel. The fascia panel shall be channel shaped extruded aluminum with standard enamel finish. The shade shall be made from a single piece of pvc coated fiberglass cloth.

2.2 COLOR

Color shall be [in accordance with Section 09000 - BUILDING COLOR AND FINISH SCHEDULE.

PART 3 EXECUTION

3.1 WINDOW TREATMENT PLACEMENT SCHEDULE

[AM#1]

Window covering shall be provided for all exterior windows <u>in classrooms, Offices and Family Room.</u>

3.2 INSTALLATION

Installation shall be in accordance with the approved detail drawings and manufacturer's installation instructions. Units shall be level, plumb, secure, and at proper height and location relative to window units. The Contractor shall furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Installation shall not be initiated until completion of room painting and finishing operations. Upon completion of the installation, window treatments shall be adjusted for form and appearance, shall be in proper operating condition, and shall be free from damage or blemishes. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 13814

BUILDING PREPARATION FOR ENERGY MONITORING AND CONTROL SYSTEMS (EMCS)

04/89

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI C12.1-\	(1988) Code for Electricity Metering

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

\-ASME-18-\	(1971; Int. Supple 19.5-1972; Errata 1974) Fluid Meters, Their Theory and Application

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

\-IEEE C57.13-\	(1993)Instrument Transformers

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

\-NEMA 250-\	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
\-NEMA ICS 1-\	(1993)Industrial Controls and Systems

1.2 GENERAL REQUIREMENTS

1.2.1 Preparation of Building for Interface

The Contractor shall provide all services, materials, and equipment necessary to prepare the building for interface to EMCS.

[AM#001]

1.2.1.a Williams Electric Direct Digital Control (DDC) Option

If the option to provide Williams Electric Direct Digital Control System components is selected, all EMCS points specified and or shown on the drawings to connect to the EMCS or DTC shall be mapped into the Ft. Hood Williams Electric Central Utility Control System (UCS). All necessary wiring and communication equipment shall be provided. DTC cabinets are not required when the Williams Electric DDC option is selected.

1.2.2 Environmental Conditions

All equipment shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered at the installed location.

1.3 SUBMITTALS

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

SD-01 Data\

Equipment and Performance\; *FIO*\.

Sixcopies of the hardware and maintenance data, in manual format, bound in hardback, loose-leaf binders, within 30 days after completing the site testing. The contents of each manual shall be identified on the cover. The manuals shall include the names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and of the nearest service representatives for each item of equipment and each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies, to be submitted after completion of the site test, shall include all modifications made during installation, checkout, and acceptance.

Hardware data, shall describe all equipment provided, including:

a. General description and specifications.

b. Installation and checkout procedures.

c. Electrical schematics and layout drawings.

d. Alignment and calibration procedures.

e. Manufacturer's repair parts list indicating sources of supply, and National Stock Number when obtainable from the manufacturer.

f. Interface definition.

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

SD-04 Drawings\

Equipment and Material\; *FIO*\.

Detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall contain complete wiring, routing, and schematic diagrams. Drawings shall show proposed layout and installation of all equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Units of the same type of equipment shall be products of a single manufacturer.

2.2 ENCLOSURES (DTC)

Enclosures shall conform to the requirements of \-NEMA 250-\ for the types specified. Finish color shall be the manufacturer's standard, unless otherwise indicated. Damaged surfaces shall be repaired and refinished using original type finish. Enclosures installed indoors shall be Type 12, or as shown. Equipment installed outdoors shall be housed in a Type 4 enclosure, unless otherwise shown.

2.3 NAMEPLATES

Laminated plastic nameplates shall be provided for all equipment furnished. Laminated plastic shall be 1/8 inch thick, white with black center core. Nameplates shall be a minimum of \&1 by 3 inches,&\ with minimum 1/4 inch high engraved block lettering. All nameplates shall be attached to the equipment.

2.4 DATA TERMINAL CABINET (DTC)

Data terminal cabinet shall be provided for each mechanical room as an interface to the data environment (DE) instrumentation and controls. No instrumentation and control devices shall be located within the DTC.

2.4.1 Enclosure

The DTC shall be a separate metallic enclosure. The DTC shall be sized to accommodate the number of functions required by the control and monitoring devices as shown plus 25 percent expansion for each type of function provided.

2.4.2 Groupings

The DTC shall be divided into analog and digital groupings, each with separate sensor and control signal wiring raceways.

2.4.3 Terminal Strips

The DTC shall be provided with double sided screw type terminal strips. One side of the terminal strip shall be used for termination of field wiring from instrumentation and controls. The other side shall be used to connect the DTC to the future FID or MUX. Terminal strips shall have individual terminal identification numbers.

2.4.4 Power

A 120-Vac, 15-A, 60 Hz duplex outlet shall be provided within 6 feet of each DTC.

2.5 INSTRUMENTATION AND CONTROL

Instrumentation and Control equipment and devices shall be as specified in section \=15950=\ HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS

2.6 WIRE AND CABLE

The Contractor shall provide all wire and cable from the sensors and control devices in the DE to the DTCs.

2.6.1 Control Wiring

2.6.1.1 Digital Functions

Control wiring for digital functions shall be No. 18 AWG minimum with 600-volt insulation. Multiconductor wire shall have an outer jacket of Polyvinyl Chloride (PVC).

2.6.1.2 Analog Functions

Control wiring for analog functions shall be No. 18 AWG minimum with 600-volt insulation, twisted and shielded, 2-, 3-, or 4-wire to match analog function hardware. Multiconductor wire shall have an outer jacket of PVC.

2.6.2 Sensor Wiring

Sensor wiring shall be No. 20 AWG minimum twisted and shielded, 2-, 3-, 4-wire to match analog function hardware. Multiconductor wire shall have an outer jacket of PVC.

2.6.3 Class 2 Low Energy Conductors

The conductor types and sizes specified for digital and analog functions shall take precedence over any requirements for Class 2 low energy remote control and signal circuit conductors specified elsewhere.

2.7 RACEWAY SYSTEMS

Raceway systems from the sensors and control devices in the DE to the DTCs shall be provided by the Contractor.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

The Contractor shall install all components and appurtenances in accordance with the manufacturer's instructions and as shown or specified. All necessary interconnections, services, and adjustments required to prepare the building for interface to an EMCS shall be furnished. All wiring, including low voltage wiring, shall be installed in metallic raceways. All other electrical work shall be in accordance with Section\=16415=\ ELECTRICAL WORK, INTERIOR and as shown. Instrumentation grounding as necessary to preclude ground loops and noise from adversely affecting equipment operations shall be installed.

3.2 EQUIPMENT INSTALLATION

3.2.1 Temperature Instruments

3.2.1.1 Resistor Temperature Detector (RTD)

When the RTD is installed in pipes or is susceptible to corrosion and vibration, the RTD shall be installed in a thermowell. RTDs which are attached to surfaces shall be clamped or bonded in place. The surface shall be thoroughly cleaned, degreased, and after RTD installation, shall be insulated from ambient temperature effects. RTDs used for space temperature sensing shall include a housing suitable for wall mounting. RTDs used for OA sensing shall have an instrument shelter to minimize solar effects, and shall be mounted to minimize building effects. RTD assemblies shall be readily accessible and installed in a manner as to allow easy replacement.

3.2.1.2 Temperature Switches

Temperature switches shall be installed as specified for RTDs. Temperature switches shall be adjusted to the proper setpoint and shall be verified by calibration. Switch contact ratings and duty shall be selected in accordance with \-NEMA ICS 1-\.

3.2.2 Relative Humidity Sensors

Relative humidity sensors shall have air guards when installed in air flows of more than 50 feet per minute across the sensor element.

3.2.3 Pressure Instruments

3.2.3.1 Pressure Sensors

Pressure sensors (all types) installed on liquid lines shall have drains. Pressure sensors installed on steam lines shall have drains and siphons. All pressure sensors shall have valves for isolation, venting, and taps for calibration. Pressure sensors shall be verified by calibration. Differential pressure sensors shall have nulling valves.

3.2.3.2 Pressure Switches

Pressure switches (all types) installed on liquid lines shall have drains. Pressure sensors installed on steam lines shall have drains and siphons. All pressure switches in water and steam lines shall have valves for isolation, venting, and taps for calibration. Pressure switches shall be adjusted to the proper setpoint, and shall be verified by calibration. Pressure switches shall be mounted higher than the process connection. Differential pressure switches shall have nulling valves. Switch contact ratings and duty shall be selected in accordance with \-NEMA ICS 1-\.

3.2.4 Flow Instruments

3.2.4.1 Flow Switches

Flow switches shall be installed in such a manner as to minimize any disturbance in the flow of fluid while maintaining reliable operation of the switch.

3.2.5 Electric Power Devices

3.2.5.1 Potential Transformers

Potential transformers shall be installed in new cabinets as shown.

3.2.5.2 Current Transformers

Current transformers shall be installed in new cabinets as shown.

3.2.5.3 Meters

Watthour meters shall be installed in new cabinets as shown.

3.2.5.4 Demand Meters

Watthour demand meters shall be installed in new cabinets as shown.

3.2.5.5 Transducers

Watthour transducers shall be installed in new cabinets as shown.

3.2.5.6 Current Sensing Relays

Relays shall be installed in new cabinets as shown.

3.2.6 Output Devices

3.2.6.1 Relays and Contactors

Relays and contactors shall be installed in new cabinets.

3.2.7 Instrument Shelters

Instrument shelters shall be installed with the bottom 4 feet above the supporting surface, using legs, and secured rigidly to minimize vibrations from winds. Instrument shelters shall be oriented facing north.

3.2.8 Enclosures

All enclosure penetrations shall be from the bottom and shall be sealed to preclude entry of water using a silicone rubber sealant.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 15895

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

PART 1 GENERAL

1.1 REFERENCES

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

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

\-ARI 350-\	(1986) Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment
\-ARI 410-\	(1991) Forced-Circulation Air-Cooling and Air-Heating Coils
\-ARI 430-\	(1989) Central-Station Air-Handling Units
\-ARI 880-\	(1990) Air Terminals
\-ARI Guideline D-\	(1987) Application and Installation of Central Station Air-Handling Units

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

\-AMCA 210-\	(1985) Laboratory Methods of Testing Fans for Rating
\-AMCA 300-\	(1996) Reverberant Room Method for Sound Testing of Fans

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABEMA)

\-ABEMA 9-\	(1990) Load Ratings and Fatigue Life for Ball Bearings
\-ABEMA 11-\	(1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI S12.32-\	(1990) Precision Methods for the Determination of Sound Power Levels of Discrete-Frequency and Narrow-Band Noise Sources in Reverberation Rooms

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 47-\	(1990) Ferritic Malleable Iron Castings
\-ASTM A 53-\	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
\-ASTM A 106-\	(1994) Seamless Carbon Steel Pipe for High-Temperature Service
\-ASTM A 123-\	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
\-ASTM A 167-\	(1993) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
\-ASTM A 181-\	(1995b) Forgings, Carbon Steel, for General-Purpose Piping
\-ASTM A 183-\	(1983; R 1990) Carbon Steel Track Bolts and Nuts
\-ASTM A 193-\	(1996) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
\-ASTM A 234-\	(1996) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
\-ASTM A 536-\	(1984; R 1993) Ductile Iron Castings
\-ASTM A 733-\	(1993) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
\-ASTM A 924-\	(1994) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
\-ASTM B 62-\	(1993) Composition Bronze or Ounce Metal Castings
\-ASTM B 75-\	(1993) Seamless Copper Tube
\-ASTM B 88-\	(1993a) Seamless Copper Water Tube
\-ASTM B 117-\	(1994) Operating Salt Spray (Fog) Testing Apparatus
\-ASTM B 650-\	(1995) Electrodeposited Engineering Chromium Coatings of Ferrous Substrates
\-ASTM C 916-\	(1985; R 1990) Adhesives for Duct Thermal Insulation
\-ASTM C 1071-\	(1991) Thermal and Acoustical Insulation

	(Glass Fiber, Duct Lining Material)
\-ASTM D 520-\	(1984; R 1989) Zinc Dust Pigment
\-ASTM D 1654-\	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
\-ASTM D 1785-\	(1994) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
\-ASTM D 2000-\	(1990 R 1994) Rubber Products in Automotive Applications
\-ASTM D 2466-\	(1994a) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
\-ASTM D 2564-\	(1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
\-ASTM D 2855-\	(1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
\-ASTM D 3359-\	(1995) Measuring Adhesion by Tape Test
\-ASTM E 84-\	(1994) Surface Burning Characteristics of Building Materials
\-ASTM E 437-\	(1992) Industrial Wire Cloth and Screens (Square Opening Series)
\-ASTM F 872-\	(1984; R 1990) Filter Units, Air-Conditioning: Viscous-Impingement Type, Cleanable
\-ASTM F 1199-\	(1988; R 1993) Cast (All Temperature and Pressures) and Welded Pipe Line Strainers (150 psig and 150 degrees F Maximum)
\-ASTM F 1200-\	(1988; R 1993) Fabricated (Welded) Pipe Line Strainers (Above 150 psig and 150 degrees F)

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

\-ASHRAE 15-\	(1994) Safety Code for Mechanical Refrigeration
\-ASHRAE 52.1-\	(1992) Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
\-ASHRAE 68-\	(1986) Laboratory Method of Testing In-Duct Sound Power Measurement Procedures for Fans

\-ASHRAE 70-\	(1991) Method of Testing Rating the Performance of Air Outlets and Inlets

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

\-ASME B1.20.1-\	(1983; R 1992) Pipe Threads, General Purpose (Inch)
\-ASME B16.3-\	(1992) Malleable Iron Threaded Fittings
\-ASME B16.5-\	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
\-ASME B16.9-\	(1993) Factory-Made Wrought Steel Buttwelding Fittings
\-ASME B16.11-\	(1991) Forged Fittings, Socket-Welding and Threaded
\-ASME B16.18-\	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
\-ASME B16.21-\	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
\-ASME B16.22-\	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
\-ASME B16.26-\	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
\-ASME B16.39-\	(1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
\-ASME B31.1-\	(1995) Power Piping
\-ASME B40.1-\	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
\-ASME BPV IX-\	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN WATER WORKS ASSOCIATION (AWWA)

\-AWWA C606-\	(1987) Grooved and Shouldered Joints

AMERICAN WELDING SOCIETY (AWS)

\-AWS D1.1-\	(1994) Structural Welding Code - Steel

COMMERCIAL ITEM DESCRIPTIONS (CID)

\-CID A-A-1419-\	(Rev D) Filter Element, Air Conditioning

	(Viscous-Impingement and Dry Types, Replaceable)

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

\-MSS SP-25-\	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
\-MSS SP-58-\	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
\-MSS SP-69-\	(1991) Pipe Hangers and Supports - Selection and Application
\-MSS SP-70-\	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
\-MSS SP-71-\	(1990) Cast Iron Swing Check Valves, Flanged and Threaded Ends
\-MSS SP-72-\	(1992) Ball Valves with Flanged or Butt-Welding Ends for General Service
\-MSS SP-80-\	(1987) Bronze Gate, Globe, Angle and Check Valves
\-MSS SP-85-\	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
\-MSS SP-110-\	(1991) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

\-NEMA MG 1-\	1993; Rev 1; Rev 2 Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 70-\	(1996) National Electrical Code
\-NFPA 90A-\	(1993) Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

\-SMACNA-01-\	(1975) Accepted Industry Practice for Industrial Duct Construction
\-SMACNA-05-\	(1992) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems
\-SMACNA-06-\	(1995) HVAC Duct Construction Standards - Metal and Flexible

\-SMACNA-10-\	(1985) HVAC Air Duct Leakage Test Manual

UNDERWRITERS LABORATORIES (UL)

\-UL-01-\	(1996; Supple) Building Materials Directory
\-UL-03-\	(1996; Supple) Electrical Construction Materials Directory
\-UL-05-\	(1996; Supple) Fire Resistance Directory (3 Vol.)
\-UL 94-\	(1991; R thru Apr 1995) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
\-UL 181-\	(1996; Rev Oct 1996) Factory-Made Air Ducts and Air Connectors
\-UL 214-\	(1993) Tests for Flame-Propagation of Fabrics and Films
\-UL 555-\	(1995) Fire Dampers
\-UL 586-\	(1996) High-Efficiency, Particulate, Air Filter Units
\-UL 705-\	(1994; Rev thru Mar 1996) Power Ventilators
\-UL 723-\	(1993; Rev Apr 1994) Test for Surface Burning Characteristics of Building Materials
\-UL 900-\	(1994) Test Performance of Air Filter Units
\-UL 1995-\	(1995) Heating and Cooling Equipment

1.2 COORDINATION OF TRADES

Ductwork, piping offsets, fittings, and accessories shall be furnished as required to provide a complete installation and to eliminate interference with other construction.

1.3 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.4 SUBMITTALS

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

SD-01 Data\

Components and Equipment Data\; *FIO*\.

Manufacturer's catalog data shall be included with the detail drawings for the following items. The data shall be highlighted to show model, size, options, etc., that are intended for consideration. Data shall be adequate to demonstrate compliance with contract requirements for the following:

a. Piping Components

b. Ductwork Components

c. Air Systems Equipment

d. Air Handling Units

e. Terminal Units

SD-04 Drawings\

Air Supply, Distribution, Ventilation, and Exhaust Equipment\; *FIO*\.

Drawings shall consist of equipment layout including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications; and piping layout showing the location of all guides and anchors, the load imposed on each support or anchor, and typical support details. Drawings shall include any information required to demonstrate that the system has been coordinated and will properly function as a unit and shall show equipment relationship to other parts of the work, including clearances required for operation and maintenance.

SD-06 Instructions\

Test Procedures\; *FIO*\.

Proposed test procedures for piping hydrostatic test, ductwork leak test, and performance tests of systems, at least 2 weeks prior to the start of related testing.

Welding Procedures\; *FIO*\.

A copy of qualified welding procedures, at least 2 weeks prior to the start of welding operations.

System Diagrams\; *GA*\.

Proposed diagrams, at least 2 weeks prior to start of related testing. System diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or

laminated plastic. After approval, these items shall be posted where directed.

SD-07 Schedules\

Test Schedules\; *FIO*\.

Proposed test schedules for hydrostatic test of piping and performance tests, at least 2 weeks prior to the start of related testing.

Field Training Schedule\; *FIO*\.

Proposed schedule for field training, at least 2 weeks prior to the start of related training.

SD-08 Statements\

Similar Services\; *FIO*\.

Statement demonstrating successful completion of similar services on at least 5 projects of similar size and scope, at least 2 weeks prior to submittal of other items required by this section.

Welding Qualification\; *FIO*\.

A list of names and identification symbols of qualified welders and welding operators, at least 2 weeks prior to the start of welding operations.

SD-09 Reports\

Test Reports\; *FIO*\.

Test reports for the piping hydrostatic test, ductwork leak test, and performance tests in booklet form, upon completion of testing. Reports shall document phases of tests performed including initial test summary, repairs/adjustments made, and final test results.

SD-13 Certificates\

Bolts\; *FIO*\.

Written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this specification. The certification shall include illustrations of product markings, and the number of each type of bolt to be furnished.

SD-19 Operation and Maintenance Manuals\

Air Supply, Distribution, Ventilation, and Exhaust Manuals\; *GA*\.

Six manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance, at least 2 weeks prior to field training. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner

for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted shall be capable of providing 4 hour onsite response to a service call on an emergency basis.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Components and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years before bid opening. The 2-year experience shall include applications of components and equipment under similar circumstances and of similar size. The 2 years must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization.

2.2 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

2.3 NAMEPLATES

Equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, and catalog number.

2.4 EQUIPMENT GUARDS AND ACCESS

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact shall be fully enclosed or guarded according to OSHA requirements. High temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard shall be properly guarded or covered with insulation of a type specified. [Catwalks,] [operating platforms,] [ladders,] [and] [guardrails] shall be provided where shown and shall be constructed according to Section \=05500=\ MISCELLANEOUS METAL.

2.5 PIPING COMPONENTS

Piping components shall be as specified in Section \=15569=\ WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH and Section \=15650=\ CENTRAL REFRIGERATED AIR-CONDITIONING SYSTEM.

2.6 ELECTRICAL WORK

Electrical motor-driven equipment specified shall be provided complete with motor, motor starter, and controls. Unless otherwise specified, electric equipment, including wiring and motor efficiencies, shall be according to

Section \=16415=\ ELECTRICAL WORK, INTERIOR. Electrical characteristics and enclosure type shall be as shown. Unless otherwise indicated, motors of 1 hp and above shall be high efficiency type. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary. Each motor shall be according to NEMA MG 1-\ and shall be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices, but not shown, shall be provided. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controller may be provided to accomplish the same function. Solid-state variable-speed controllers shall be utilized for motors rated 10 hp or less. Adjustable frequency drives shall be used for larger motors.

2.7 CONTROLS

Controls shall be provided as specified in Section \=15950=\ HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS.

2.8 DUCTWORK COMPONENTS

2.8.1 Metal Ductwork

All aspects of metal ductwork construction, including all fittings and components, shall comply with \-SMACNA-06-\ unless otherwise specified. Elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes may be used. Static pressure Class 2 inch w.g.ductwork shall meet the requirements of Seal Class C. Class 3 through 4 inch shall meet the requirements of Seal Class A. Sealants shall conform to fire hazard classification specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Pressure sensitive tape shall not be used as a sealant. Spiral lock seam duct, and flat oval shall be made with duct sealant and locked with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA-06. The sealant shall be applied to the exposed male part of the fitting collar so that the sealer will be on the inside of the joint and fully protected by the metal of the duct fitting. One brush coat of the sealant shall be applied over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar will not be acceptable. Outdoor air intake ducts and plenums shall be fabricated with watertight soldered or brazed joints and seams.

2.8.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 15 degrees, for an included angle of 30 degrees. Transitions for converging air flow shall be made with each side pitched in a maximum of 30 degrees, for an included angle of 60 degrees, or shall be as indicated. Factory-fabricated reducing fittings for systems using round duct sections when formed to the shape of the ASME short flow nozzle, need not comply with the maximum angles specified.

2.8.1.2 Insulated Nonmetallic Flexible Duct Runouts

Flexible duct runouts shall be used only where indicated. Runout length shall be as shown on the drawings, but shall in no case exceed 10 feet. Runouts shall be preinsulated, factory fabricated, and shall comply with NFPA 90A and UL 181. Either field or factory applied vapor barrier shall be provided. Where coil induction or high velocity units are supplied with vertical air inlets, a streamlined and vaned and mitered elbow transition piece shall be provided for connection to the flexible duct or hose. The last elbow to these units, other than the vertical air inlet type, shall be a die-stamped elbow and not a flexible connector. Insulated flexible connectors may be used as runouts. The insulated material and vapor barrier shall conform to the requirements of Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. The insulation material surface shall not be exposed to the air stream.

2.8.1.3 General Service Duct Connectors

A flexible duct connector approximately 6 inches in width shall be provided where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, the flexible material shall be secured by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, the flexible material locked to metal collars shall be installed using normal duct construction methods. The composite connector system shall comply with UL 214 and be classified as "flame-retarded fabrics" in UL-01.

2.8.2 Fibrous Glass Ductwork

Fiber glass duct shall not be used on this site.

2.8.3 Ductwork Accessories

2.8.3.1 Duct Access Doors

Access doors shall be provided in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system, and unless otherwise shown, shall conform to SMACNA-06. Access doors shall be provided upstream and downstream of air flow measuring primaries and heating and cooling coils. Doors shall be minimum 15 x 18 inches, unless otherwise shown. Where duct size will not accommodate this size door, the doors shall be made as large as practicable. Doors 24 x 24 inches or larger shall be provided with fasteners operable from both sides. Doors in insulated ducts shall be the insulated type.

2.8.3.2 Splitters and Manual Balancing Dampers

Splitters and manual balancing dampers shall be furnished with accessible operating mechanisms. Where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitters shall be operated by quadrant operators or 3/16 inch rod brought through the side of the duct with locking setscrew and bushing. Two rods are required on splitters over 8 inches. Manual volume control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be

2 gauges heavier than the duct in which installed. Unless otherwise indicated, multileaf dampers shall be opposed blade type with maximum blade width of 12 inches. Access doors or panels shall be provided for all concealed damper operators and locking setscrews. Unless otherwise indicated, the locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with stand-off mounting brackets, bases, or adapters to provide clearance between the duct surface and the operator not less than the thickness of the insulation. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.8.3.3 Air Deflectors and Branch Connections

Air deflectors shall be provided at duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. 45 degree entry connections shall be used in lieu of deflectors or extractors for branch connections. All air deflectors, except those installed in 90 degree elbows, shall be provided with an approved means of adjustment. Adjustment shall be made from easily accessible means inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, external adjustments shall be provided with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Air deflectors shall be factory-fabricated units consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Air deflectors shall be factory or field assembled. Blade air deflectors, also called blade air extractors, shall be approved factory fabricated units consisting of equalizing grid and adjustable blade and lock. Adjustment shall be easily made from the face of the diffuser or by position adjustment and lock external to the duct. Stand-off brackets shall be provided on insulated ducts and are described herein. Fixed air deflectors, also called turning vanes, shall be provided in 90 degree elbows.

2.8.4 Duct Sleeves, Framed Prepared Openings, Closure Collars

2.8.4.1 Duct Sleeves

Square and rectangular ducts passing through floors, walls, ceilings, or roof shall be installed through framed prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and prepared openings. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Framed prepared openings shall be fabricated from 20 gauge galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, ASTM A 53, Schedule 20 shall be used. Sleeve shall provide 1 inch clearance between the duct and the sleeve or 1 inch clearance between the insulation and the sleeve for insulated ducts.

2.8.4.2 Framed Prepared Openings

Openings shall have 1 inch clearance between the duct and the opening or 1

inch clearance between the insulation and the opening for insulated ducts.

2.8.4.3 Closure Collars

Collars shall be fabricated of galvanized sheet metal not less than 4 inches wide, unless otherwise indicated, and shall be installed on exposed ducts on each side of walls or floors where sleeves or prepared openings are provided. Collars shall be installed tight against surfaces. Collars shall fit snugly around the duct or insulation. Sharp edges of the collar around insulated duct shall be ground smooth to preclude tearing or puncturing the insulation covering or vapor barrier. Collars for square and rectangular ducts shall be fabricated from 18 gauge galvanized steel. Collars shall be installed with fasteners on maximum 6 inch centers, except that not less than 4 fasteners shall be used.

2.8.4.4 Casing

Casings shall be terminated at the curb line and anchored by the use of galvanized angle iron sealed and bolted to the curb, as indicated in \-SMACNA-06-\.

2.8.4.5 Access Doors

Access doors shall be provided in each section of the casing. Door frames shall be welded in place, and each door shall be neoprene gasketed, hinged with minimum of two brass hinges, and fastened with a minimum of two brass tension fasteners operable from inside and outside of the casing. Where possible, doors shall be \^900 x 450 mm^\ \~36 x 18 inches~\ located \^450 mm^\ \~18 inches~\ above the floor. Where the space available will not accommodate doors of this size, doors as large as the space will accommodate shall be provided. Doors shall swing so that fan suction or pressure holds door in closed position, and shall be airtight. A push-button station to stop the supply fan shall be located inside the casing where indicated.

2.8.4.6 Duct Liner

Unless otherwise specified, duct liner shall conform to \-ASTM C 1071-\, Type I or II.

2.8.5 Sound Attenuation Equipment

a. System With Total Pressure of 4 Inch Water Gauge and Lower:

Sound attenuators shall be provided as shown on the drawings and as per schedule. Lined ducts shall be provided where indicate. Factory fabricated sound attenuators shall be used and constructed of galvanized steel sheets. Outer casing shall be not less than 22 gauge. Acoustical fill shall be fibrous glass. Net sound reduction shall be as indicated. Values shall be obtained on a test unit not less than 24 inches outside dimensions made by a certified nationally recognized independent acoustical laboratory. Air flow capacity shall be as indicated or required. Pressure drop through the attenuator shall not exceed the value indicated, or shall not be in excess of 15 percent of the total external static pressure of the air handling system, whichever is less. Sound attenuators shall be acoustically tested with metal duct inlet and

outlet sections while under the rated air flow conditions. Noise reduction data shall include the effects of flanking paths and vibration transmission. Sound attenuators shall be constructed to be airtight when operating at the internal static pressure indicated or specified for the duct system, but in no case less than 2 inch water gauge.

b. Acoustical Duct Liner:

Acoustical duct lining shall be fibrous glass designed exclusively for lining ductwork and shall conform to the requirements of ASTM C 1071, Type I and II. Liner composition may be uniform density, graduated density, or dual density, as standard with the manufacturer. Lining shall be coated, not less than 1 inch thick. Where acoustical duct liner is used, the full thickness of exterior insulation is also required as per Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Duct sizes shown shall be increased to compensate for the thickness of the lining used. Net insertion loss value, static pressure drop, and air flow velocity capacity data shall be certified by a nationally recognized independent acoustical laboratory. The areas of lining on this project are at high velocities at nominal 3000 fpm. The liner shall be fully adhered with adhesive and mechanically fastened at a minimum of 6"O.C. across the width of the duct at 16" intervals down the duct. Coat the upstream edge of any length with adhesive and install a metal nosing over these edges.

2.8.6 Diffusers, Registers, and Grilles

Units shall be factory-fabricated of steel, corrosion-resistant steel, or aluminum and shall distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Outlets for diffusion, spread, throw, and noise level shall be as required for specified performance. Performance shall be certified according to ASHRAE 70. Inlets and outlets shall be sound rated and certified according to ASHRAE 70. Sound power level shall be as indicated. **[AM#001]** _____.

2.8.6.1 Diffusers

Diffuser types shall be as indicated. Ceiling mounted units shall be furnished with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Diffusers shall be provided with air deflectors of the type indicated. Air handling troffer diffusers shall conform to the requirements of UL-03 for the interchangeable use as cooled or heated air supply diffusers or return air units. Air handling troffer diffusers shall be insulated and have directional control to change vertical and horizontal throws. Ceiling mounted units shall be installed with rims tight against ceiling. Sponge rubber gaskets shall be provided between ceiling and surface mounted diffusers for air leakage control. Suitable trim shall be provided for flush mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Return or exhaust units shall be similar to supply diffusers. Slot diffusers shall be insulated and have directional control.

2.8.6.2 Registers and Grilles

Units shall be four-way directional-control type, except that return and

exhaust registers may be fixed horizontal or vertical louver type similar in appearance to the supply register face. Registers shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall supply diffusers shall be installed at least 6 inches below the ceiling unless otherwise indicated. Four-way directional control may be achieved by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Grilles shall be as specified for registers, without volume control damper.

2.8.7 Louvers

Louvers for installation in exterior walls which are associated with the air supply and distribution system shall be as specified in Section \=07600=\ SHEET METALWORK, GENERAL.

2.8.8 Air Vents, Penthouses, and Goosenecks

Air vents, penthouses, and goosenecks shall be fabricated from galvanized steel [or aluminum] sheets with galvanized structural shapes. Sheet metal thickness, reinforcement, and fabrication shall conform to \-SMACNA-06-\. Louver blades shall be accurately fitted and secured to frames. Edges of louver blades shall be folded or beaded for rigidity and baffled to exclude driving rain. Air vents, penthouses, and goosenecks shall be provided with bird screen.

2.8.9 Bird Screens and Frames

Bird screens shall conform to ASTM E 437, Type I, Class 1, 2 by 2 mesh, 0.063 inch diameter aluminum wire 0.031 inch diameter stainless steel wire. Frames shall be removable type or stainless steel or extruded aluminum.

2.9 AIR SYSTEMS EQUIPMENT

2.9.1 Fans

Fans shall be tested and rated according to AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drive. V-belt drives shall be designed for not less than 150 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 15 hp and below and fixed pitch as defined by ARI Guideline D. Variable pitch sheaves shall be selected to drive the fan at a speed which will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, a replaceable sheave shall be provided when needed to achieve system air balance. Motors for V-belt drives shall be provided with adjustable rails or bases. Removable metal guards shall be provided for all exposed V-belt drives, and speed-test openings shall be provided at the center of all rotating shafts. Fans shall be provided with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Fan and motor assemblies shall be provided with vibration-isolation supports or mountings as indicated. Vibration-isolation units shall be standard products with published loading ratings. Each fan shall be selected to produce the capacity required at the fan static pressure indicated. Sound power level shall be as indicated. The sound power level values shall be

obtained according to AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

2.9.1.1 Centrifugal Fans

Centrifugal fans shall be fully enclosed, single-width single-inlet, or double-width double-inlet, AMCA Pressure Class I, II, or III as required or indicated for the design system pressure. Impeller wheels shall be rigidly constructed, accurately balanced both statically and dynamically. Fan blades shall be airfoil design and shall have overhung pulleys and a bearing on each side of the wheel. Fan wheels 36 inches or less in diameter may have one or more extra long bearings between the fan wheel and the drive. Bearings shall be sleeve type, self-aligning and self-oiling with oil reservoirs, or precision self-aligning roller or ball-type with accessible grease fittings or permanently lubricated type. Grease fittings shall be connected to tubing and serviceable from a single accessible point. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABEMA 9 and ABEMA 11. Fan shafts shall be steel, accurately finished, and shall be provided with key seats and keys for impeller hubs and fan pulleys. Each fan outlet shall be of ample proportions and shall be designed for the attachment of angles and bolts for attaching flexible connections. Motors, unless otherwise indicated, shall not exceed 1800 rpm and shall have dripproof enclosures. Motor starters shall be Variable frequency controllers as specified below.

2.9.1.2 In-Line Centrifugal Fans

In-line fans shall have centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Fans shall be mounted in a welded tubular casing. Air shall enter and leave the fan axially. Inlets shall be streamlined with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Fan bearings and drive shafts shall be enclosed and isolated from the air stream. Fan bearings shall be sealed against dust and dirt and shall be permanently lubricated, and shall be precision self aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABEMA 9 and ABEMA 11. Motors shall have dripproof enclosure. Motor starters shall be magnetic across-the-line with general-purpose enclosures with HOA switch on face of starter.

2.9.1.3 Centrifugal Type Power Roof Ventilators

Fans shall be direct or V-belt driven with backward inclined, non-overloading wheel. Motor compartment housing shall be hinged or removable and weatherproof, constructed of heavy gauge aluminum. Fans shall be provided with birdscreen, disconnect switch, gravity or motorized] dampers, roof curb, and extended base. Motors enclosure shall be dripproof type. Lubricated bearings shall be provided.

2.9.2 Coils

Coils shall be fin-and-tube type constructed of seamless copper tubes and copper fins mechanically bonded or soldered to the tubes. Copper tube wall thickness shall be a minimum of 0.024 inches. Copper fins shall be 0.0045 inch

minimum thickness. Casing and tube support sheets shall be not lighter than 16 gauge galvanized steel, formed to provide structural strength. When required, multiple tube supports shall be provided to prevent tube sag. Each coil shall be tested at the factory under water at not less than 400 psi air pressure and shall be suitable for 200 psi working pressure. Coils shall be mounted for counterflow service. Coils shall be rated and certified according to ARI 410.

2.9.2.1 Water Coils

Water coils shall be installed with a pitch of not less than 1/8 inch per foot of the tube length toward the drain end. Headers shall be constructed of cast iron, welded steel or copper. Each coil shall be provided with a plugged vent and drain connection extending through the unit casing.

2.9.3 Air Filters

Air filters shall be listed according to requirements of \-UL 900-\, except high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method shall be as listed under the Label Service and shall meet the requirements of \-UL 586-\.

2.9.3.1 Extended Surface Pleated Panel Filters

Filters shall be 2 inch depth, sectional, disposable type of the size indicated and shall have an average efficiency of 25 to 30 percent when tested according to ASHRAE 52.1. Initial resistance at 500 feet per minute 0.36 inches water gauge. Filters shall be UL Class 2. Media shall be nonwoven cotton and synthetic fiber mat. A wire support grid bonded to the media shall be attached to a moisture resistant fiberboard frame. All four edges of the filter media shall be bonded to the inside of the frame to prevent air bypass and increase rigidity.

2.9.3.2 Holding Frames

Frames shall be fabricated from not lighter than 16 gauge sheet steel with rust-inhibitor coating. Each holding frame shall be equipped with suitable filter holding devices. Holding frame seats shall be gasketed. All joints shall be airtight.

2.9.3.3 Filter Gauges

Filter gauges shall be dial type, diaphragm actuated draft and shall be provided for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 3-7/8 inches in diameter, shall have white dials with black figures, and and shall have a range of 2.0 inch wc. Each gauge shall incorporate a screw operated zero adjustment and shall be furnished complete with two static pressure tips with integral compression fittings, two molded plastic vent valves, two 5 foot minimum lengths of 1/4 inch diameter aluminum tubing, and all hardware and accessories for gauge mounting.

2.10 AIR HANDLING UNITS

2.10.1 Factory-Fabricated Air Handling Units

Units shall be single-zone draw-through type. Units shall include fan, coils, airtight insulated casing, filters, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, combination sectional filter-mixing box, vibration-isolators, and appurtenances required for specified operation. Vibration isolators shall be as indicated. Each air handling unit shall have physical dimensions suitable to fit space allotted to the unit and shall have the capacity indicated. Air handling unit shall have published ratings based on tests performed according to ARI 430.

2.10.1.1 Casings

Casing sections shall be single wall type, constructed of a minimum 18 gauge galvanized steel, or 18 gauge steel outer casing protected with a corrosion resistant paint finish according to paragraph FACTORY PAINTING. Casing shall be designed and constructed with an integral structural steel frame such that exterior panels are non-load bearing. Exterior panels shall be individually removable. Removal shall not affect the structural integrity of the unit. Casings shall be provided with inspection doors, access sections, and access doors as indicated. Inspection and access doors shall be insulated, fully gasketed, double-wall type, of a minimum 18 gauge outer and inner panels. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 12 inches wide by 12 inches high. Access doors shall be minimum 24 inches wide and shall be the full height of the unit casing or a minimum of 6 ft. whichever is less. Access Sections shall be according to paragraph AIR HANDLING UNITS. Drain pan shall be double-bottom type constructed of 16 gauge stainless steel, pitched to the drain connection. Drain pans shall be constructed water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Intermediate drain pans or condensate collection channels and downspouts shall be provided, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Each casing section handling conditioned air shall be insulated with not less than 1 inch 1-1/2 pound density coated fibrous glass material having a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Factory applied fibrous glass insulation shall conform to ASTM C 1071, except that the minimum thickness and density requirements do not apply, and shall meet the requirements of NFPA 90A. Foam-type insulation is not aceptable. Foil-faced insulation shall not be an acceptable substitute for use on double-wall access doors and inspections doors and casing sections. Duct liner material, coating, and adhesive shall conform to fire-hazard requirements specified in Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Exposed insulation edges and joints where insulation panels are butted together shall be protected with a metal nosing strip or shall be coated to conform to meet erosion resistance requirements of ASTM C 1071. A latched and hinged inspection door, shall be provided in the fan and coil sections. Additional inspection doors, access doors and access sections shall be provided as shown on each ahu between preheat and cooling coils.

2.10.1.2 Heating and Cooling Coils

Coils shall be provided as specified in paragraph AIR SYSTEMS EQUIPMENT, for

types indicated.

2.10.1.3 Air Filters

Air filters shall be as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.10.1.4 Access Sections and Filter/Mixing Boxes

Access sections shall be provided where indicated and shall be furnished with access doors as shown. Access sections and filter/mixing boxes shall be constructed in a manner identical to the remainder of the unit casing and shall be equipped with access doors. Mixing boxes shall be designed to minimize air stratification and to promote thorough mixing of the air streams.

2.10.1.5 Dampers

Dampers shall be as specified in paragraph CONTROLS and mounted on the combination filter mixing box outside air and return air openings.

2.10.1.6 Fans

Fans shall be double-inlet, centrifugal aifoil type with each fan in a separate scroll. Fans and shafts shall be dynamically balanced prior to installation into air handling unit, then the entire fan assembly shall be statically and dynamically balanced at the factory after it has been installed in the air handling unit. Fans shall be mounted on steel shafts accurately ground and finished. Fan bearings shall be sealed against dust and dirt and shall be precision self-aligning ball or roller type. Bearing life shall be L50 rated at not less than 200,000 hours as defined by ABEMA 9 and ABEMA 11. Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Bearings shall be supported by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Bearings may not be fastened directly to the unit sheet metal casing. Fans and scrolls shall be furnished with coating indicated. Fans shall be driven by a unit-mounted or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Belt guards shall be the three sided enclosed type with solid or expanded metal face. Belt drives shall be designed for not less than a 1.3 service factor based on motor nameplate rating. Motor sheaves shall be variable pitch for 20 hp and below and fixed pitch above 20 hp. Where fixed sheaves are required, variable pitch sheaves may be used during air balance, but shall be replaced with an appropriate fixed sheave after air balance is completed. Variable pitch sheaves shall be selected to drive the fan at a speed that will produce the specified capacity when set at the approximate midpoint of the sheave adjustment. Motors for V-belt drives shall be provided with adjustable bases. Fan motors shall have splashproof enclosures. Motor starters shall be variable frequency drives as follows:

2.11 VARIABLE FREQUENCY DRIVE UNITS

Units shall be solid state with adjustable frequency and voltage,

three-phase output capable of driving standard NEMA class B induction motors. The drives shall utilize diode bridge rectifying circuitry with either variable voltage or pulse width modulation DC to AC convertors. Silicon controlled rectifiers (SCR) that are phased back shall not be used in rectifying circuitry. The drives shall be designed to be used on variable torque loads and shall be capable of providing sufficient torque to allow the motor to break away from rest upon first application of power. Unit shall be rated for 60 Hz, three-phase systems, capable of operating within voltage parameters of plus 10 to minus 15 percent of rated line voltage, and be rated for the full load amps of the maximum HP within its class. Each unit shall be factory tested at maximum HP, rated full load current and at an ambient of 40 degrees C for a period of not less than 24 hours. If a component fails, it shall be replaced and the test restarted for the full time period. The unit shall not add any current or voltage transients to the input AC power distribution system nor shall the controller be affected by transients from other devices on the AC power distribution system. Unit shall be protected to comply with ANSI C37.90.1, Guide for Surge Withstand Capability (SWC) Test (2,500 volts for 1 minute) and UL 508 Electrical Industrial Control Equipment.

2.11.1. Variable Frequency Drive Unit Features

Variable frequency drive units shall have the following features:

a. Isolated power for control circuits.

b. Manually resettable motor overload protection for each phase.

c. Adjustable current limiting circuitry to provide soft motor starting. Maximum starting current shall not exceed 200 percent of motor full load current.

d. Independent acceleration and deceleration time adjustment, manually adjustable from 2 to 30 seconds. Set timers to the equipment manufacturer's recommended time in the above range.

e. Provide 4 to 20 mA current follower circuitry for interface with pressure sensor and transmitter devices.

f. Automatic frequency adjustment from 20 Hz to 60 Hz.

g. By-pass starter with circuitry to protect and isolate the variable speed controller. When the variable speed controller is in the by-pass mode the solid-state components shall be isolated from the power supply on both the line and motor side.

h. Controller efficiency at any speed shall be not less than 92 percent.

i. At 100 percent speed the input power factor shall be less than 0.95 and shall not be less than 0.90 at any other speed.

j. Door interlocked fused safety disconnect or door interlocked circuit breaker switch shall disconnect all input power.

k. Two N.O. and two N.C. dry contacts rated 120 volts, 10 amperes, 60 Hz for remote indication of the following: controller system shutdown with auto restart, system shutdown without auto restart, and system running.

l. Limit harmonic distortion produced by the unit to no more than 3 percent voltage at 100 percent current at any speed.

2.11.2 Controllers

Controllers shall have circuitry to initiate an orderly shutdown after the motor stops spinning and when conditions are corrected. The controller shall not be damaged by the following electrical disturbances:

a. Incorrect phase sequence.

b. Single phasing.

c. Over voltage in excess of 10 percent.

d. Under voltage in excess of 15 percent.

e. Running over current above 150 percent (shall not automatically reset for this condition).

f. Instantaneous over current above 150 percent (shall not automatically reset for this condition).

g. Surge voltage in excess of 1,000 volts.

h. Short duration power outages of 12 cycles or less (i.e. distribution line switching, generator testing, automatic transfer switch operations).

2.11.3 Accessories

Units shall have the following door-mounted accessories:

a. AC Power light.

b. Ammeter (RMS motor current).

c. Hand-Off-Automatic switch.

d. Manual speed HAND mode.

e. System protection light indicating that the system has a shutdown and will not automatically restart.

f. System protection light indicating that the system has shutdown, but will restart when conditions return to normal.

g. Manual variable speed controller by-pass switch when required.

h. Diagnostic shutdown indicator lights for each shutdown condition

Sound power level of AHU fan shall be as scheduled. The sound power level values shall be obtained according to AMCA 300 or ASHRAE 68.

2.12 TERMINAL UNITS

2.12.1 Variable Air Volume (VAV) Terminal Units

VAV terminal units shall be the type, size, and capacity shown and shall be mounted in the ceiling or wall cavity and shall be suitable for single or dual duct system applications. Actuators and controls shall be as specified in paragraph CONTROLS. Unit enclosures shall be constructed of galvanized steel not lighter than 22 gauge or aluminum sheet not lighter than 18 gauge. Single or multiple discharge outlets shall be provided as required. Units with flow limiters are not acceptable. Unit air volume shall be factory preset and calibrated. The units shall be field adjustable. Reheat coils shall be provided as indicated. A flow chart shall be attached to each unit. Acoustic performance of the terminal units shall be based upon units tested according to \-ARI 880-\. Sound power level shall be as indicated. Discharge sound power shall be shown for minimum and 1-1/2 and 3" inches water gauge inlet static pressure. Acoustical lining shall be according to \-NFPA 90A-\.

2.12.1.1 Variable Volume, Single Duct

Variable volume, single duct, terminal units shall be provided with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Units shall control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 3/4 to 4 inch water gauge). Internal resistance of units shall not exceed 0.4 inch water gauge at maximum flow range. External differential pressure taps separate from the control pressure taps shall be provided for air flow measurement with a 0 to 1 inch water gauge range. Unit volume controller shall have electronic inlet flow sensor, electronic contoller electronic air valve and 24V electric two position hydronic valve operators. Electronic VAV box controller shall be matched with electronic space temperature sensor. All VAV box electronic controllers within an AHU system shall be functionally interconnected provide the capability to read all control values of any VAV terminals on that AHU from any thermosensor location electronically through a hand held display unit. Three hand held units shall be provided and delivered during commisioning walkthrough.

2.12.1.2 Reheat Units

Hot Water Coils: Hot-water coils shall be fin-and-tube type constructed of seamless copper tubes and copper fins mechanically bonded or soldered to the tubes. Headers shall be constructed of cast iron, welded steel or copper. Casing and tube support sheets shall be 16 gauge, galvanized steel, formed to provide structural strength. Tubes shall be correctly circuited for proper water velocity without excessive pressure drop and they shall be drainable where required or indicated. At the factory, each coil shall be tested at not less than 250 psi air pressure and shall be suitable for 200 psi working pressure. Drainable coils shall be installed in the air handling units with a pitch of not less than 1/8 inch per foot

of tube length toward the drain end. Coils shall conform to the provisions of ARI 410.

2.13 FACTORY PAINTING

Units which are not of galvanized construction according to ASTM A 123 or ASTM A 924 shall be factory painted with a corrosion resisting paint finish. Internal and external ferrous metal surfaces shall be cleaned, phosphatised and coated with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors shall be submitted. Rating of failure at the scribe mark shall be not less than 6, average creepage not greater than 1/8 inch. Rating of the inscribed area shall not be less than 10, no failure. On units constructed of galvanized steel which have been welded, exterior surfaces of welds or welds that have burned through from the interior shall receive a final shop docket of zinc-rich protective paint according to ASTM D 520 Type I.

PART 3 EXECUTION

3.1 INSTALLATION

Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

3.1.1 Piping

Pipe components and accessories shall be installed in accordance with Section \=15569=\ WATER AND STREAM HEATING; OIL, GAS, OR BOTH; UP TO 20 MBTUH and Section \=15650=\ CENTRAL REFRIGERATED AIR CONDITIONING SYSTEM.

3.1.2 Metal Ductwork

Installation shall be according to SMACNA-06 unless otherwise indicated. Duct supports for sheet metal ductwork shall be according to SMACNA-06, unless otherwise specified. Friction beam clamps indicated in SMACNA-06 shall not be used. Risers on high velocity ducts shall be anchored in the center of the vertical run to allow ends of riser to move due to thermal expansion. Supports on the risers shall allow free vertical movement of the duct. Supports shall be attached only to structural framing members and concrete slabs. Supports shall not be anchored to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Where C-clamps are used, retainer clips shall be provided.

3.1.3 Fibrous Glass Ductwork

Shall not be used on this project.

3.1.4 Acoustical Duct Lining

Lining shall be applied in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C 916, Type I, NFPA 90A, UL 723, and ASTM E 84. Top and bottom pieces shall lap the side pieces and shall be secured by fully adhering to the duct metal and additionally secured with mechanical pin facteners on ^″ o.c. across the widthe of duct and 16" oc down the length of the duct. Welded pins, cup-head pins, or adhered clips shall not distort the duct, burn through, nor mar the finish or the surface of the duct. Pins and washers shall be flush with the surfaces of the duct liner and all breaks and punctures of the duct liner coating shall be sealed with the nonflammable, fire resistant adhesive. Exposed downstream edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent delamination of glass fibers. Upstream edge of the line shall be protected from lifting by a metal nosing. Duct liner may be applied to flat sheet metal prior to forming duct through the sheet metal brake. Lining at the top and bottom surfaces of the duct shall be additionally secured by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA-06 to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, will be acceptable. The liner in the main ducts at fan discharge see high velocities, and shall be secured according to methods cited above in addition to any further manufacturer’s requirements.

3.1.5 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, temporary dust control protection shall be provided. The distribution system (supply and return) shall be protected with temporary seal-offs at all inlets and outlets at the end of each day's work. Temporary protection shall remain in place until system is ready for startup.

3.1.6 Insulation

Thickness and application of insulation materials for ductwork, piping, and equipment shall be according to Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Outdoor air intake ducts and plenums shall be externally insulated up to the point where the outdoor air reaches the air handling unit.

3.1.7 Duct Test Holes

Holes with closures or threaded holes with plugs shall be provided in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Extensions, complete with cap or plug, shall be provided where the ducts are insulated.

3.1.8 Power Roof Ventilator Mounting

Foamed 1/2 inch thick, closed-cell, flexible elastomer insulation shall cover width of roof curb mounting flange. Where wood nailers are used,

holes shall be pre-drilled for fasteners.

3.1.9 Power Transmission Components Adjustment

V-belts and sheaves shall be tested for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Belts on drive side shall be uniformly loaded, not bouncing. Alignment of direct driven couplings shall be to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.2 FIELD PAINTING AND PIPING IDENTIFICATION

Finish painting of items only primed at the factory or surfaces not specifically noted otherwise and identification for piping are specified in Section 09900 PAINTING, GENERAL.

3.3 PIPING HYDROSTATIC TEST

After cleaning, water piping shall be hydrostatically tested at a pressure equal to 150 percent of the total system operating pressure for period of time sufficient to inspect every joint in the system and in no case less than 2 hours. Leaks shall be repaired and piping retested until test is successful. No loss of pressure will be allowed. Leaks shall be repaired by re-welding or replacing pipe or fittings. Caulking of joints will not be permitted. Concealed and insulated piping shall be tested in place before covering or concealing.

3.4 DUCTWORK LEAK TEST

Ductwork leak test shall be performed for the entire air distribution and exhaust system, including fans, and coils, Ductwork leak test shall be completed with satisfactory results prior to applying insulation to ductwork exterior. The standard of acceptance is no audible, or sensible leak that can be felt by human hand. If doubt occurs, soap bubble test a joint that is in doubt. If any growing bubble forms, reseal the joint.

3.5 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of foreign matter. **A permanent coil bypass shall be provided as Detailed for ahu water coils to prevent flushing water from passing through coils, there shall be no rust coloration to the system after the system has been flushed.** Strainers and valves shall be thoroughly cleaned. After flushing, blowdown one of the strainers through a coffee filter to demonstrate there is no rust coloration. Prior to testing and balancing, air shall be removed from water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Inside of air terminal units, ducts, plenums, and casing shall be thoroughly cleaned of debris and blown free of small particles of rubbish and dust and then shall be vacuum cleaned before installing outlet faces. Equipment shall be wiped clean, with traces of oil, dust, dirt, or paint spots removed. Temporary filters

shall be provided prior to startup of all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.6 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in Section 15990 TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS. Testing, adjusting, and balancing shall begin only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.7 PERFORMANCE TESTS

After testing, adjusting, and balancing has been completed as specified, each system shall be tested as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Corrections and adjustments shall be made as necessary to produce the conditions indicated or specified. Capacity tests and general operating tests shall be conducted by an experienced engineer. Tests shall cover a period of not less than 5 days for each system and shall demonstrate that the entire system is functioning according to the specifications. Coincidental chart recordings shall be made at points indicated on the drawings for the duration of the time period and shall record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

3.8 FIELD TRAINING

The Contractor shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Training shall be provided for a period of 16 hours of normal working time and shall start after the system is functionally complete but prior to the performance tests. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 15950

HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)

\-AMCA 500-\	(1989) Test Methods for Louvers, Dampers and Shutters

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 269-\	(1994a) Seamless and Welded Austenitic Stainless Steel Tubing for General Service
\-ASTM B 88-\	(1996) Seamless Copper Water Tube
\-ASTM D 635-\	(1991) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
\-ASTM D 1693-\	(1994) Environmental Stress-Cracking of Ethylene Plastics

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

\-ASME B16.34-\	(1988) Valves - Flanged, Threaded, and Welding End
\-ASME B40.1-\	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
\-ASME BPV VIII Div 1-\	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

CODE OF FEDERAL REGULATIONS (CFR)

\-47 CFR 15-\	Radio Frequency Devices

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

\-IEEE C62.41-\	(1991) Surge Voltages in Low-Voltage AC Power Circuits

INTERNATIONAL SOCIETY FOR MEASUREMENT AND CONTROL (ISA)

\-ISA S7.3-\	(1975; R 1981) Quality Standard for Instrument Air

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

\-NEMA 250-\	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 70-\	(1996) National Electrical Code
\-NFPA 90A-\	(1993) Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

\-UL 94-\	(1996) Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
\-UL 268A-\	(1993; Rev Apr 1994) Smoke Detectors for Duct Application
\-UL 508-\	(1993) Industrial Control Equipment
\-UL 555S-\	(1996) Leakage Rated Dampers for Use in Smoke-Control Systems
\-UL 916-\	(1994; Rev thru May 1996) Energy Management Equipment

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

1.2.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall investigate the mechanical, electrical, and finish conditions that could affect the work to be performed, shall arrange such work accordingly, and shall furnish all work necessary to meet such conditions.

[AM#001]

1.2.3 WILLIAMS ELECTRIC DIRECT DIGITAL CONTROL OPTION

In lieu of Single Loop Controls, the contractor has the option to provide Williams Electric Direct Digital Controls. If the option is exercised, all hardware (sensors, wiring, control valves, dampers, actuators,

thermometers, etc.) except for controllers shall meet requirements specified here-in-after. Control logic as specified and indicated by single loop control drawings shall be provided in an equivalent manner by direct digital control algorithms resident in the Ft. Hood Williams Electric Central System Computer and in the Williams Electric Remote Control Units (RCUs). The contracting officer shall make the determination of equivalent control logic. The minimum number of RCUs shall be four (4), one in each air handler room and one in the central plant. The RCUs shall communicate continually with the central system computer but shall be capable of controlling systems in a stand alone manner should communication be interupted. In addition to the single loop logic indicated, the Williams Electric Direct Digital Control option shall provide communication with and control of all VAV terminals and chiller master panel. Control commissioning requirements shall be altered by the contractor to reflect the equivalent direct digital control commissioning. Contractor shall coordinate requirements of Section 13814, BUILDING PREPARATION FOR ENERGY MONITORING AND CONTROL SYSTEMS. If this option is selected the contractor shall map all EMCS monitoring and control points back to the Williams Electric central system computer located at Ft. Hood and any necessary central system hardware and software changes or additions required shall be provided by the contractor. Any work accomplished on the central system shall be coordinated with the post EMCS operators.

1.3 SUBMITTALS

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

SD-01 Data\

Equipment Compliance Booklet\; *FIO*\.

An HVAC control system equipment compliance booklet (ECB) in indexed booklet form with numbered tabs separating the information on each device. It shall consist of, but not be limited to, data sheets and catalog cuts which document compliance of all devices and components with the specifications. The ECB shall be indexed in alphabetical order by the unique identifiers. Devices and components which do not have unique identifiers shall follow the devices and components with unique identifiers and shall be indexed in alphabetical order according to their functional name. The ECB shall include a bill of materials for each HVAC control system. The bill of materials shall function as the table of contents for the ECB and shall include the device's unique identifier, device function, manufacturer, model/part/catalog number used for ordering, and tab number where the device information is located in the ECB.

SD-04 Drawings\

HVAC Control System\; *FIO*\.

Drawings on A1 34 by 22 inch sheets in the form and arrangement shown. The drawings shall use the same abbreviations, symbols, nomenclature and device

identifiers shown. Each control-system element on a drawing shall have a unique identifier as shown. All HVAC control system drawings shall be delivered together as a complete submittal. Drawings shall be submitted for each HVAC system.

a. HVAC control system drawings shall include the following:

Sheet One: Drawing index, HVAC control system legend.

Sheet Two: Valve schedule, damper schedule.

Sheet Three: Compressed air station schematic.

Sheet Four: HVAC control system schematic and equipment schedule.

Sheet Five: HVAC control system sequence of operation and ladder diagram.

Sheet Six: HVAC control panel arrangement, control panel cross-section, and control panel inner door layout.

Sheet Seven: HVAC control panel back-panel layout.

Sheet Eight: Control loop wiring diagrams.

Sheet Nine: Motor starter and relay wiring diagram.

Note: Repeat sheets four through nine for each AHU system.

b. An HVAC control system drawing index showing the name and number of the building, military site, State or other similar designation, and Country. The drawing index shall list all HVAC control system drawings, including the drawing number, sheet number, drawing title, and computer filename when used.

c. An HVAC control system legend showing generic symbols and the name of devices shown on the HVAC control system drawings.

d. A valve schedule showing each valve's unique identifier, size, flow coefficient (Cv), pressure drop at specified flow rate, spring range, positive positioner range, actuator size, close-off pressure data, dimensions, and access and clearance requirements data.

e. A damper schedule showing each damper and actuator's identifier, nominal and actual sizes, orientation of axis and frame, direction of blade rotation, spring ranges, operation rate, positive positioner ranges, locations of actuators and damper end switches, arrangement of sections in multi-section dampers, and methods of connecting dampers, actuators, and linkages. The damper schedule shall include the maximum leakage rate at the operating static-pressure differential. The damper schedule shall contain actuator selection data supported by calculations of the torque required to move and seal the dampers, access and clearance requirements.

f. A compressed-air station schematic diagram showing all equipment, including: compressor with motor horsepower and voltage; starter; isolators; manual bypasses; tubing sizes; drain piping and drain traps; reducing valves; dryer; and data on manufacturer's names and model numbers, mounting, access, and clearance requirements. Air compressor and air dryer

data shall include calculations of the air consumption of current-to-pneumatic transducers and any other control system devices to be connected to the compressed air station, and the compressed air supply dewpoint temperature at 20 psig.

g. An HVAC control system equipment schedule showing the control loop, device unique identifier, device function, setpoint, input range, and additional important parameters (i.e. output range).

h. An HVAC control system sequence of operation.

i. An HVAC control system ladder diagram showing all relays, contacts, pilot lights, switches, fuses and starters connected to the control system.

j. HVAC control panel arrangement drawings showing both side and front views of the panel. The drawing shall show panel and mounting dimensions.

k. HVAC control panel cross-section drawings showing mounting rails and standoffs for devices.

l. HVAC control panel inner door layout drawings showing both front and rear views of the inner door. The drawings shall show device locations, labels, nameplate legends, and fabrication details.

m. HVAC control panel back-panel layout drawings showing device locations, labels, nameplate legends, terminal block layout, fabrication details, and enclosure operating temperature-rise calculations.

n. HVAC control system wiring diagrams showing functional wiring diagrams of the interconnection of conductors and cables to HVAC control panel terminal blocks and to the identified terminals of devices, starters and package equipment. The wiring diagrams shall show all necessary jumpers and ground connections. The wiring diagrams shall show the labels of all conductors. Sources of power required for HVAC control systems and for packaged-equipment control systems shall be identified back to the panel-board circuit breaker number, HVAC system control panel, magnetic starter, or packaged equipment control circuit. Each power supply and transformer not integral to a controller, starter, or packaged equipment shall be shown. The connected volt-ampere load and the power supply volt-ampere rating shall be shown.

SD-08 Statements\

Commissioning Procedures\; *FIO*\ .

a. Six copies of the HVAC control system commissioning procedures, in indexed booklet form, 60 days prior to the scheduled start of commissioning. Commissioning procedures shall be provided for each HVAC control system, and for each type of terminal-unit control system. The commissioning procedures shall reflect the format and language of this specification, and refer to devices by their unique identifiers as shown. The commissioning procedures shall be specific for each HVAC system, and shall give detailed step-by-step procedures for commissioning of the system.

b. Commissioning procedures documenting detailed, product-specific set-up procedures, configuration procedures, adjustment procedures, and

calibration procedures for each device. Where the detailed product-specific commissioning procedures are included in manufacturer supplied manuals, reference may be made in the HVAC control system commissioning procedures to the manuals.

c. Commissioning procedures documenting controller configuration checksheets for each controller listing all configuration parameters, dip switch and jumper settings, and initial recommended P, I and D values. The configuration parameters shall be listed in the order in which they appear during the configuration process. Each configuration parameter shall be noted as being: set per specs with no field adjustment required, set per specs but field adjustable, or not applicable.

d. Commissioning procedures showing a time clock configuration checksheet listing all parameters, and switch settings. The parameters shall be listed in the order which they appear during the setup process.

e. An HVAC control system commissioning procedures equipment list that lists the equipment to be used to accomplish commissioning. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Performance Verification Test Procedures\; *[FIO]*\.

[Six] [_____] copies of the HVAC control system performance verification test procedures, in indexed booklet form, 60 days before the Contractor's scheduled test dates. The performance verification test procedures shall refer to the devices by their unique identifiers as shown, shall explain, step-by-step, the actions and expected results that will demonstrate that the HVAC control system performs in accordance with the sequences of operation. An HVAC control system performance verification test equipment list shall be included that lists the equipment to be used during performance verification testing. The list shall include manufacturer name, model number, equipment function, the date of the latest calibration, and the results of the latest calibration.

Training Course Materials\; *[FIO]*\.

[Six] [_____] copies of HVAC control system training course material 30 days prior to the scheduled start of the training course. The training course material shall include the operation manual, maintenance and repair manual, and paper copies of overheads used in the course. An HVAC control system training course, in outline form, with a proposed time schedule. Approval of the planned training schedule shall be obtained from the Government at least [60] [_____] days prior to the start of the training.

SD-09 Reports\

Commissioning Report\; *[FIO]*\.

Six copies of the HVAC control system commissioning report, in indexed booklet form, within 30 days after completion of the system commissioning. The commissioning report shall include data collected during the HVAC control system commissioning and shall follow the format of the commissioning procedures. The commissioning report shall include all controller and time clock checksheets with final values listed for all

parameters, setpoints, P, I, D setting constants, calibration data for all devices, and results of adjustments.

Performance Verification Test Report\; *[FIO]*\.

Six copies of the HVAC control system performance verification test report, in indexed booklet form, within 30 days after completion of the test. The HVAC control system performance verification test report shall include data collected during the HVAC control system performance verification test. The original copies of data gathered during the performance verification test shall be turned over to the Government after Government approval of the test results.

SD-13 Certificates\

ASME Air-Storage Tank Certificate\; *[FIO]*\.

An ASME Air-Storage Tank Certificate for each storage tank.

SD-18 Records\

Service Organizations\; *[FIO]*\.

Six copies of a list of service organizations qualified to service the HVAC control system. The list shall include the service organization name, address, technical point of contact and telephone number, and contractual point of contact and telephone number.

SD-19 Operation and Maintenance Manuals\

Operation Manual\; *[FIO]*\.

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

Six copies of the HVAC control system operation manual and HVAC control system maintenance and repair manual for each HVAC control system 30 days before the date scheduled for the training course.

1.4 DELIVERY AND STORAGE

Products shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants, within the storage-condition limits published by the equipment manufacturer. Dampers shall be stored so that seal integrity, blade alignment and frame alignment are maintained.

1.5 OPERATION MANUAL

An HVAC control system operation manual for each HVAC control system, in indexed booklet form, shall be provided. The operation manual shall include the HVAC control system sequence of operation, and procedures for the HVAC system start-up, operation and shut-down. The operation manual shall include as-built HVAC control system detail drawings. The operation manual shall include the as-built controller configuration checksheets, the as-built time clock configuration checksheet, the HVAC control system front panel description, the procedures for changing HVAC system controller

setpoints, the procedures for gaining manual control of processes, the time clock manufacturer's manual control of processes, the time clock manufacturer's operation manual, and the controller manufacturer's operation manual.

a. The HVAC control system front panel description shall explain the meaning and use of the lights, switches, gauges, and controller displays located in the front panel. Each light, switch, gauge, and display described shall be numbered and referenced to a drawing of the front panel.

b. The procedures for changing HVAC system controller setpoints shall describe the step-by-step procedures required to change: the process variable setpoints of controllers, the alarm setpoints of controllers, the controller bias settings, and controller setpoint reset schedules.

c. The procedures for gaining manual control of processes shall describe step-by-step procedures required to gain manual control of devices and manually adjust their positions.

1.6 MAINTENANCE AND REPAIR MANUAL

An HVAC control system maintenance and repair manual for each HVAC control system, in indexed booklet form in hardback binders, shall be provided. The maintenance and repair manual shall include the routine maintenance checklist, a recommended repair methods list, a list of recommended maintenance and repair tools, the qualified service organization list, the as-built commissioning procedures and report, the as-built performance verification test procedures and report, and the as-built equipment data booklet (EDB).

a. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all devices listed in the equipment compliance booklet (ECB), the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.

b. The recommended repair methods list shall be arranged in a columnar format and shall list all devices in the equipment compliance booklet (ECB) and state the guidance on recommended repair methods, either field repair, factory repair, or whole-item replacement.

c. The as-built equipment data booklet (EDB) shall include the equipment compliance booklet (ECB) and all manufacturer supplied user manuals and information.

d. If the operation manual and the maintenance and repair manual are provided in a common volume, they shall be clearly differentiated and separately indexed.

PART 2 PRODUCTS

2.1 MATERIAL AND EQUIPMENT

Material and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products which are of a

similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience must be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. The equipment items shall be supported by a service organization. The Contractor shall submit a certified list of qualified permanent service organizations and qualifications. These service organizations shall be reasonably convenient to the equipment on a regular and emergency basis during the warranty period.

2.2 GENERAL EQUIPMENT REQUIREMENTS

2.2.1 Electrical and Electronic Devices

All electrical, electronic, and electro-pneumatic devices not located within an HVAC control panel shall have a NEMA Type 1 enclosure in accordance with \-NEMA 250-\ unless otherwise shown.

2.2.2 Standard Signals

The output of all analog transmitters and the analog input and output of all single-loop controllers and function modules shall be 4-to-20 mAdc signals. The signal shall originate from current-sourcing devices and shall be received by current-sinking devices.

2.2.3 Ambient Temperature Limits

Ambient Temperature Actuators and positive positioners, and transmitters shall operate within temperature limit ratings of 40 to 140 degrees F. All panel-mounted instruments shall operate within limit ratings of 35 to 120 degrees F and 10 percent to 95 percent relative humidity, noncondensing. All devices installed outdoors shall operate within limit ratings of minus 40 to plus 150 degrees F.

2.2.4 Nameplates, Lens Caps, and Tag Nameplates

Nameplates, lens caps, and lens caps bearing legends as shown and tags bearing device-unique identifiers as shown shall have engraved or stamped characters. A plastic or metal tag shall be mechanically attached directly to each device or attached by a metal chain or wire. Each air flow measurement station shall have a tag showing flow rate range for signal output range, duct size, and identifier as shown.

2.3 MATERIALS

2.3.1 Tubing

2.3.1.1 Copper

Copper tubing shall conform to \-ASTM B 88-\ and shall have sweat fittings and valves.

2.3.1.2 Plastic

Plastic tubing shall have barbed fittings and valves. Plastic tubing shall have the burning characteristics of linear low-density polyethylene tubing, shall be self-extinguishing when tested in accordance with \-ASTM D 635-\, shall have \-UL 94-\ V-2 flammability classification, and shall withstand stress cracking when tested in accordance with \-ASTM D 1693-\. Plastic-tubing bundles shall be provided with Mylar barrier and flame-retardant polyethylene jacket.

2.3.1.3 Stainless Steel

Stainless steel tubing shall conform to \-ASTM A 269-\, and shall have stainless steel compression fittings.

2.3.2 Wiring

2.3.2.1 Terminal Blocks

Terminal blocks shall be insulated, modular, feed-through, clamp style with recessed captive screw-type clamping mechanism, shall be suitable for rail mounting, and shall have end plates and partition plates for separation or shall have enclosed sides.

2.3.2.2 Control Wiring for 24-Volt Circuits

Control wiring for 24-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 300-volt service.

2.3.2.3 Wiring for 120-Volt Circuits

Wiring for 120-volt circuits shall be 18 AWG minimum, stranded copper and shall be rated for 600-volt service.

2.3.2.4 Analog Signal Wiring Circuits

Analog signal wiring circuits within control panels shall not be less than 20 AWG and shall be rated for 300-volt service.

2.3.2.5 Instrumentation Cable

Instrumentation cable shall be 18 AWG, stranded copper, single or multiple-twisted, minimum 2 inch lay of twist, 100 percent shielded pairs, and shall have a 300-volt insulation. Each pair shall have a 20 AWG tinned-copper drain wire and individual overall pair insulation. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape, overall 20 AWG tinned-copper cable drain wire, and overall cable insulation.

2.3.2.6 Nonconducting Wiring Duct

Nonconducting wiring duct in control panels shall have wiring duct in control panels shall have slotted sides, snap-on duct covers, have slotted

sides, snap-on duct covers, fittings for connecting ducts, mounting clips for securing ducts, and wire-retaining clips.

2.3.2.7 Transformers

Step-down transformers shall be utilized where control equipment operates at lower than line circuit voltage. Transformers, other than transformers in bridge circuits, shall have primaries wound for the voltage available and secondaries wound for the correct control circuit voltage. Transformers shall be sized so that the connected load is 80 percent of the rated capacity or less. Transformers shall conform to \-UL 508-\.

2.4 ACTUATORS

Actuators shall be pneumatic, electric or electronic as shown and shall be provided with mounting and connecting hardware. Actuators shall fail to their spring-return positions on signal or power failure ,except that variable air volume (VAV) terminal unit actuators shall be electronic and remain in the last position prior to signal failure. The actuator stroke shall be limited in the direction of power stroke by an adjustable stop. Actuators shall have a visible position indicator. Actuators shall smoothly open or close the devices to which they are applied and shall have a full stroke response time of 60 seconds or less. Pneumatic actuators shall be rated for 25 psig operating pressure except for high-pressure cylinder-type actuators. .

2.4.1 Valve Actuators

Valve actuators shall be selected to provide a minimum of 125 percent of the motive power necessary to operate the valve over its full range of operation. VAV reheat coil valve actuators shall be two position electric. Main AHU valve acutators shall be pneumatic.

2.4.2 Positive Positioners

Positive positioners are required for pneumatic actuators. Each positive positioner shall be a pneumatic relay with a mechanical feedback mechanism and an adjustable operating range and starting point.

2.5 AUTOMATIC CONTROL VALVES

2.5.1 Valve Assembly

Valves shall have stainless-steel stems and stuffing boxes with extended necks to clear the piping insulation. Unless otherwise stated, valves shall have globe style bodies. Valve bodies shall be designed for not less than 125 psig working pressure or 150 percent of the system operating pressure, whichever is greater. Valve leakage rating shall be 0.01 percent of rated Cv.

2.5.2 Butterfly-Valve Assembly

Butterfly valves shall be threaded lug type suitable for dead-end service, and for modulation to the fully-closed position, with carbon-steel bodies and noncorrosive discs, stainless steel shafts supported by bearings, and EPDM seats suitable for temperatures from minus 20 to plus 250 degrees F. Valves shall have a manual means of operation independent of the actuator. The rated Cv for butterfly valves shall be the valve Cv at 70% open (60 degrees open).

2.5.3 Two-Way Valves

Two-way modulating valves shall have equal-percentage characteristics.

2.5.4 Three-Way Valves

Three-way valves shall provide linear flow control with constant total flow throughout full plug travel.

2.5.5 Duct-Coil and Terminal-Unit-Coil Valves

Control valves with either flare-type or solder-type ends shall be provided for duct or terminal-unit coils. Flare nuts shall be furnished for each flare-type end valve.

2.5.6 Valves for Chilled-Water, Condenser-Water, and Glycol Service

Bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends. Bodies for valves from 2 to 3 inches inclusive shall be of brass, bronze or iron. Bodies for 2 inch valves shall have threaded ends. Bodies for valves from 2-1/2 to 3 inches shall have flanged-end connections. Valve Cv shall be within 100 percent to 125 percent of the Cv shown. Internal valve trim shall be brass or bronze except that valve stems may be type 316 stainless steel. Valves 4 inches and larger shall be butterfly valves.

2.5.7 Valves for Hot-Water Service

Valves for hot-water service below 250 Degrees F shall be as follows: Bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends. Bodies for 2 inch valves shall have threaded ends. Bodies for valves from 2 to 3 inches inclusive shall be of brass, bronze, or iron. Bodies for valves 4 inches and larger shall be iron. Bodies for valves 2-1/2 inches and larger shall be provided with flanged-end connections. Valve Cv shall be within 100 percent to 125 percent of the Cv shown. Internal trim (including seats, seat rings, modulating plugs, and springs) of valves controlling water hotter than 210 degrees F shall be Type 316 stainless steel. Internal trim for valves controlling water 210 degrees F or less shall be brass or bronze. Nonmetallic parts of hot-water control valves shall be suitable for a minimum continuous operating temperature of 250 degrees F or 50 degrees F above the system design temperature, whichever is higher. Valves 4 inches is higher. Valves 4 inches and larger shall be butterfly valves.

2.6 DAMPERS

2.6.1 Damper Assembly

A single damper section shall have blades no longer than 48 inches and shall be no higher than 72 inches. Maximum damper blade width shall be 8 inches. Larger sizes shall be made from a combination of sections. Dampers shall be steel, or other materials where shown. Flat blades shall be made rigid by folding the edges. All blade-operating linkages shall be within the frame so that blade-connecting devices within the same damper section will not be located directly in the air stream. Damper axles shall be 0.5 inch (minimum) plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings. Pressure drop through dampers shall not exceed 0.04 inch water gauge at 1,000 fpm in the wide-open position. Frames shall not be less than 2 inches in width. Dampers shall be tested in accordance with \-AMCA 500-\.

2.6.1.1 Operating Links

Operating links external to dampers (such as crankarms, connecting rods, and line shafting for transmitting motion from damper actuators to dampers) shall withstand a load equal to at least twice the maximum required damper-operating force. Rod lengths shall be adjustable. Links shall be brass, bronze, zinc-coated steel, or stainless steel. Working parts of joints and clevises shall be brass, bronze, or stainless steel. Adjustments of crankarms shall control the open and closed positions of dampers.

2.6.1.2 Damper Types

Dampers shall be parallel blade type.

2.6.2 Outside-Air, Return-Air, and Relief-Air Dampers

The dampers shall be provided where shown. Blades shall have interlocking edges and shall be provided with compressible seals at points of contact. The channel frames of the dampers shall be provided with jamb seals to minimize air leakage. Dampers shall not leak in excess of 20 cfm per square foot at 4 inches water gauge static pressure when closed. Seals shall be suitable for an operating temperature range of minus 40 to plus 200 degrees F. Dampers shall be rated at not less than 2000 fpm air velocity.

2.6.3 Mechanical and Electrical Space Ventilation Dampers

The dampers shall be as shown. Dampers shall not leak in excess of 80 cfm per square foot at 4 inches water (gauge) static pressure when closed. Dampers shall be rated at not less than 1500 fpm air velocity.

blade.

2.7 DUCT SMOKE DETECTORS

[AM#1]

Duct smoke detectors shall conform to the requirements of \-UL 268A-\ and shall be photoelectric type. Duct smoke detectors shall have perforated sampling tubes extended into the air duct. Detector circuitry shall be mounted in a metallic enclosure exterior to the duct. Detector or detector base shall be of the addressable type, compatible with the addressable fire alarm system. Detectors shall have manual reset. Detectors shall be rated for air velocities that include air flows between 500 and 4000 fpm. Detectors shall be powered from the fire alarm control panel. Detectors shall have two sets of normally open alarm contacts and two sets of normally closed alarm contacts. Detectors shall be connected to the building fire alarm panel for alarm initiation. A remote annunciation lamp and accessible remote reset switch shall be provided for duct detectors that are mounted eight feet or more above the finished floor and for detectors that are not readily visible. Remote lamps and switches as well as each affected fan unit shall be properly identified in etched rigid plastic placards.

[AM#1]

2.7.1 Photoelectric Detectors

Detectors shall operate on a light scattering concept using and LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating between \~1.9 and 2.9 percent per foot~\when tested in accordance with \-UL 268-\. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.8 INSTRUMENTATION

2.8.1 Measurements

Transmitters shall be factory calibrated to provide an output of 4 to 20 mAdc over the indicated ranges:

a. Conditioned space temperature, from 50 to 85 degrees F.

b. Duct temperature, from 40 to 140 degrees F except that return-air temperature for economizer operation shall be minus 30 to plus 130 degrees F.

c. High-temperature hot-water temperature, from 200 to 500 degrees F.

d. Chilled-water temperature, from 30 to 100 degrees F.

e. Dual-temperature water, from 30 to 240 degrees F.

f. Heating hot-water temperature, from 100 to 250 degrees F.

g. Condenser-water temperature, from 30 to 130 degrees F.

h. Outside-air temperature, from minus 30 to 130 degrees F.

i. Relative humidity, 0 to 100 percent for space and duct high-limit applications.

j. Differential pressure for VAV supply-duct static pressure from 0 to 2.0 inches water (gauge).

k. Pitot-tube air-flow measurement station and transmitter, from 0 to 0.1 inch water (gauge) for flow velocities of 700 to 1200 fpm, 0 to 0.25 inch water (gauge) for velocities of 700 to 1800 fpm, or 0 to 0.5 inch water (gauge) for velocities of 700 to 2500 fpm.

l. Electronic air-flow measurement station and transmitter, from 125 to 2500 fpm.

2.8.2 Temperature Instruments

2.8.2.1 Resistance Temperature Detectors (RTD)

Temperature sensors shall be 100 ohms 3- or 4-wire RTD. Each RTD shall be platinum with a tolerance of plus or minus 0.1 percent at 32 degrees F, and shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Each RTD shall be furnished with an RTD transmitter as specified, integrally-mounted unless otherwise shown.

2.8.2.2 Continuous-Averaging RTD

Continuous-averaging RTDs shall have a tolerance of plus or minus 1.0 degree F at the reference temperature, and shall be of sufficient length to ensure that the resistance represents an average over the cross-section in which it is installed. The sensing element shall have a bendable copper sheath. Each averaging RTD shall be furnished with an RTD transmitter as specified, to match the resistance range of the averaging RTD.

2.8.2.3 RTD Transmitter

The RTD transmitter shall accept a 3-wire 100 ohm RTD input. The transmitter shall be a 2-wire, loop-powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required temperature measurement. The output error shall not exceed 0.1 percent of the calibrated span. The transmitter shall include offset and span adjustments.

adjustments.

2.8.3 Electronic Air-Flow-Measurement Stations and Transmitters

2.8.3.1 Stations

Each station shall consist of an array of velocity sensing elements and an air-flow straightener. Air-flow straighteners shall be contained in a flanged sheet-metal or aluminum casing. The velocity sensing elements shall be of the RTD or thermistor type, producing a linear output. The sensing elements shall be distributed across the duct cross-section in the quantity and pattern specified by the published installation instructions of the station manufacturer. The resistance to airflow through the air-flow measurement station shall not exceed 0.08 inch water gauge at an air-flow of 2,000 fpm. Station construction shall be suitable for operation at air-flows of up to 5,000 fpm over a temperature range of 40 to 120 degrees F, and accuracy shall be plus or minus 3 percent over a range

of 125 to 2,500 fpm. In outside-air measurement or in low-temperature air delivery applications, the station shall be certified by the manufacturer to be accurate as specified over a temperature range of minus 20 to plus 120 degrees F. In outside-air measurement applications, the air-flow straightener shall be constructed of 1/8 inch aluminum honeycomb and the depth of the straightener shall not be less than 1.5 inch.

2.8.3.2 Transmitters

Each transmitter shall produce a linear, temperature compensated 4-to-20 mAdc output corresponding to the required velocity measurement. The output error of the transmitter shall not exceed 0.5 percent of the calibrated measurement. Each transmitter shall have offset and span adjustments.

2.8.4 Differential Pressure Instruments

The instrument shall be a pressure transmitter with an integral sensing element. The instrument over pressure rating shall be 300 percent of the operating pressure. The sensor/transmitter assembly accuracy shall be plus or minus 2 percent of full scale. The transmitter shall be a 2-wire, loop-powered device. The transmitter shall produce a linear 4-to-20 mAdc output corresponding to the required pressure measurement. Each transmitter shall have offset and span adjustments.

2.8.5 Thermowells

Thermowells shall be Series 300 stainless steel with threaded brass plug and chain, 2 inch lagging neck and extension-type well, and inside diameter and insertion length as required for the application.

2.8.6 Sunshields

Sunshields for outside-air temperature sensing elements shall prevent the sun from directly striking the temperature sensing elements. The sunshields shall be provided with adequate ventilation so that the sensing element responds to the ambient temperature of the surroundings. The top of each sunshield shall have a galvanized-metal rainshield projecting over the face of the sunshield. The sunshields shall be painted white or shall be unpainted aluminum.

2.9 THERMOSTATS

Thermostat ranges shall be selected so that the setpoint is adjustable [without tools] between plus or minus 10 degrees F of the setpoint shown. Thermostats shall be electronic or electric.

2.9.1 Nonmodulating Room Thermostats

Contacts shall be single-pole double-throw (SPDT), hermetically sealed, and wired to identified terminals. Maximum differential shall be 5 degrees F. Room thermostats shall be enclosed with separate locking covers (guards). Thermostats shall have manual switches as required by the application.

2.9.2 Microprocessor-Based Room Thermostats

Microprocessor-based thermostats shall have built-in keypads for scheduling of day and night temperature settings. [Access to the scheduling mode shall be by a password control code.] When out of the scheduling mode, thermostats shall have continuous display of time, with AM and PM indicator, continuous display of day of week, and either continuous display of room temperature with display of temperature setpoint on demand, or continuous display of temperature setpoint with display of room temperature on demand. In the programmable mode, the display shall be used for interrogating time program ON-OFF setpoints for all 7 days of the week. The time program shall allow 2 separate temperature-setback intervals per day. The thermostats shall have a means for temporary and manual override of the program schedule, with automatic program restoration on the following day. Thermostats shall have a replaceable battery to maintain the timing and maintain the schedule in memory for 1 year in the event of a power outage. Maximum differential shall be 2 degrees F. When used for heat-pump applications, the thermostat shall have an emergency heat switch.

2.9.3 Modulating Room Thermostats

Modulating room thermostats shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Each thermostat shall have an adjustable throttling range of 4 to 8 degrees F for each output. Room thermostats shall be enclosed with separate locking covers (guards).

2.9.4 Nonmodulating Capillary Thermostats and Aquastats

Each thermostat shall have a capillary length of at least 5 feet,^\ shall have adjustable direct-reading scales for both setpoint and differential, and shall have a differential adjustable from \^3 to 9 degrees C.^\ \ Aquastats shall be of the strap-on type, with 10 degrees F fixed differential.

2.9.5 Low-Temperature-Protection Thermostats

Low-temperature-protection thermostats shall be, low-temperature safety thermostats, with NO and NC contacts [and manual reset], with an element length of 20 feet, which shall respond to the coldest 18 inch segment.

2.9.6 Modulating Capillary Thermostats

Each thermostat shall have either one output signal, two output signals operating in unison, or two output signals operating in sequence, as required for the application. Thermostats shall have adjustable throttling ranges of 4 to 8 degrees F for each output.

2.10 PRESSURE SWITCHES AND SOLENOID VALVES

2.10.1 Pressure Switches

Each switch shall have an adjustable setpoint with visible setpoint scale. Range shall be as shown. Differential adjustment shall span 20 to 40 percent of the range of the device.

2.10.2 Differential-Pressure Switches

Each switch shall be an adjustable diaphragm-operated device with two SPDT contacts, with taps for sensing lines to be connected to duct pressure fittings designed to sense air pressure. These fittings shall be of the angled-tip type with tips pointing into the air stream. The setpoint shall not be in the upper or lower quarters of the range and the range shall not be more than three times the setpoint. Differential shall be a maximum of 0.15 inch water gauge at the low end of the range and 0.35 inch water gauge at the high end of the range.

2.10.3 Pneumatic Electric (PE) Switches

Each switch shall have an adjustable setpoint range of 3 to 20 psig with a switching differential adjustable from 2 to 5 psig. The switch action shall be SPDT.

2.10.4 Solenoid-Operated Pneumatic (EP) Valves

Each valve shall have three-port operation: common, normally open, and normally closed. Each valve shall have an outer cast-aluminum body and internal parts of brass, bronze, or stainless steel. The air connection shall be a 3/8 inch NPT threaded connection. Valves shall be rated for 50 psig when used in a control system that operates at 25 psig or less, or 150 psig when used in a control system that operates in the range of 25 to 100 psig.

2.11 INDICATING DEVICES

2.11.1 Thermometers

2.11.1.1 Piping System Thermometers

Piping system thermometers shall have brass, malleable iron or aluminum alloy case and frame, clear protective face, permanently stabilized glass tube with indicating-fluid column, white face, black numbers, and a 9 inch scale. Thermometers for piping systems shall have rigid stems with straight, angular, or inclined pattern.

2.11.1.2 Piping System Thermometer Stems

Thermometer stems shall have expansion heads as required to prevent breakage at extreme temperatures. On rigid-stem thermometers, the space between bulb and stem shall be filled with a heat-transfer medium.

2.11.1.3 Non-Averaging Air-Duct Thermometers

Air-duct thermometers shall have perforated stem guards and 45-degree adjustable duct flanges with locking mechanism.

2.11.1.4 Averaging Air-Duct Thermometers

Averaging thermometers shall have a 3-1/2 inch (nominal) dial, with black legend on white background, and pointer traveling through a 270-degree arc.

2.11.1.5 Accuracy

Thermometers shall have an accuracy of plus or minus 1 percent of scale range. Thermometers shall have a range suitable for the application.

2.11.2 Pressure Gauges

Gauges shall be 2 inch (nominal) size, back connected, suitable for field or panel mounting as required, shall have black legend on white background, and shall have a pointer traveling through a 270-degree arc. Accuracy shall be plus or minus 3 percent of scale range. Gauges shall meet requirements of \-ASME B40.1-\.

2.11.2.1 Pneumatic Actuator Gauges

Field mounted gauges for indicating signal input to pneumatic actuators shall have a scale of 0 to 30 psig with 1 psig graduations.

2.11.2.2 Air Storage Tank, Filter, and Dryer Gauges

Gauges for air storage tanks, or for use before and after dryers or dirt and oil filters, shall have a scale of 0 to 160 psig with 2 psig graduations.

2.11.2.3 Hydronic-System Gauges

Gauges for hydronic-system applications shall have ranges and graduations as shown.

2.11.2.4 Control Panel Pressure Gauges

Panel mounted air pressure gauges shall have a scale of 0 to 30 psig with 1 psig graduations.

2.11.3 Low Differential Pressure Gauges

Gauges for low differential-pressure measurements shall be a minimum of 3.5 inch (nominal) size with two sets of pressure taps, and shall have a diaphragm-actuated pointer, white dial with black figures, and pointer zero adjustment. Gauges shall have ranges and graduations as shown. Accuracy shall be plus or minus 2 percent of scale range.

2.12 SINGLE-LOOP CONTROLLERS

2.12.1 Controller Features

The controller shall be a microprocessor-based single-loop device that does not require Contractor generated software. The controller shall be mountable in a panel cutout measuring 3.62 by 3.62 inches. The controller shall have field scalable process variable, a remote setpoint analog input and an analog output with adjustable high and low end limits and proportional control manual reset adjustment. The analog output shall result from proportional, integral and derivative (PID) control. The analog output shall be configurable as direct acting and reverse acting. The controller shall have keyboard, display, auto/manual selection for control of its analog output, remote setpoint adjustment/local setpoint adjustment selection with adjustable high-end and low-end limits, ratio and bias adjustments on remote setpoint input, operator-initiated

self-tune/manual-tune selection, anti-reset wind-up feature, and 2 independent SPDT contact-closure outputs (PV alarm and deviation alarm). The controller shall be configurable to power-up in automatic with local setpoint control and in automatic with remote setpoint control. The range of hysteresis adjustment shall be not smaller than from 1 percent to 5 percent of process variable input span. The controller shall power the analog output loop to 20 milliamperes when connected to a load of 600 ohms. The controller shall be capable of retransmitting the process variable to 20 milliamperes when connected to 600 ohms. The controller shall have 5-year battery backup to store operating parameters or shall have nonvolatile memory.

2.12.2 Parameter Input and Display

Control parameters shall be entered and displayed directly, in the correct engineering units, through a series of keystrokes on a front-panel display with a 3-1/2 digit, 7-segment display, with decimal point and polarity indication. The use of this display shall allow manual interrogation of setpoint, mode constants, and values of the process variable and output.

2.12.3 Controller Electrical Requirements

Each controller shall be powered by 120 volts ac. Power consumption shall not be greater than 25 watts. Each controller shall provide electrical noise isolation between the ac power line and the process variable input, remote setpoint input, and output signals and of not less than 100 db at 60 Hz common-mode rejection ratio, and not less than 60 db at 60 Hz normal-mode rejection ratio.

2.12.4 Controller Accuracy

The controller shall have an accuracy of plus or minus 0.30 percent of input span, plus or minus 1 digit.

2.12.5 Self-Tuning

The controller self-tuning operation shall apply proportional, integral, and derivative modes of control and shall modify the mode constants as required. Self-tuning shall only be in operation when selected from the front panel.

2.12.6 Manual-Tuning

The controller manual-tuning operation shall provide proportional, integral, and derivative control modes, or any combination thereof, by means of individual mode constant adjustments. These adjustments shall be set for the appropriate value if a particular control mode action is desired, or to zero if that particular mode is not desired. The proportional-mode constant shall be adjustable from 0 to 200 percent of input signal range, the integral-mode constant shall be adjustable from 0 to 20 repeats per minute, and derivative-mode constant shall be adjustable from 0 to 5 minutes.

2.13 CONTROL DEVICES AND ACCESSORIES

Control device and accessory input impedance shall not exceed 250 ohms.

2.13.1 Function Modules

Function modules shall accept mAdc analog input signals to produce mAdc analog output signals or contact output signals. Modules shall have zero and span adjustments for analog outputs, and setpoint adjustments for contact outputs. Module output span accuracy shall be plus or minus 1 percent of input span. Modules shall be rail-mounted as shown. Power consumption shall be not greater than 5 watts.

2.13.1.1 Minimum-Position Switch and Temperature-Setpoint Device

Minimum-position switch and temperature-setpoint device shall accept a 1000 ohms potentiometer input and shall produce a steady analog output. In temperature setpoint applications the potentiometer shall be single-turn, suitable for wall mounting, enclosed in a locking metal or heavy duty plastic enclosure and shall have a graduated dial corresponding to the range of the setpoint adjustment. In a minimum position switch application the potentiometer shall be mounted on or internal to the minimum position switch. The device shall have its input signal electrically or optically isolated from output. Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8, output signal.

2.13.1.2 Signal-Inverter Modules

Signal inverter shall accept an analog input signal and shall have sufficient output capacity to drive the output signal through a circuit with an impedance of not less than 600 ohms. The output shall be electrically isolated from the input and the device shall have a moisture resistant coating. Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8, output signal.

2.13.1.3 High-Low Signal Selector

High-low signal-selector modules shall accept analog input signals and select either the highest or the lowest input signal as the output signal. The signal selector shall be powered by 120 Vac and the output signal shall be electrically isolated from the input signal.

2.13.1.4 Sequencer Modules (Dual Limit Alarm)

Sequencer modules (dual limit alarms) shall accept an analog input signal and shall provide two contact closure outputs. Each output shall have an adjustable independent contact setpoint with an adjustable switching differential range between 1 percent and 100 percent of the input span. The setpoint shall be adjustable between 0 percent and 100 percent of the input span. Setpoint and switching differential (deadband) adjustment potentiometers shall be internal, top-accessed potentiometers or screws. Sequencers shall return all contacts to their zero input signal condition when power is interrupted. The device shall have moisture resistant coating.

2.13.1.5 Loop Driver Modules

Loop driver module shall accept an analog input signal and shall have a circuit input impedance not greater than 100 ohms. The loop driver module shall have sufficient output capacity to drive the output signal through a

circuit with an impedance range of not less than 1000 ohms. The output shall be electrically isolated from the input and the device shall have moisture resistant coating. Mounting socket shall be an 8 pin base with pins 1, 2, 3 ac power input, 4, 5, 6 input signal, 7, 8 output signal.

2.13.2 Relays

Relays shall be 2-pole, double-throw (2PDT) with a 10-ampere resistive rating at 120 Vac, and shall have an enclosed 120-Vac coil with 8 pin blade connectors, and a matching rail-mounted socket. Power consumption shall not be greater than 3 watts.

2.13.3 Time-Delay Relays

Time delay relays shall be 2PDT with 8 pin connectors, dust cover, and a matching rail-mounted socket. Adjustable timing range shall be 0 to 5 minutes. Power consumption shall be not greater than 3 watts.

2.13.4 Time Clocks

Each time clock shall be a 365-day programmable timing device with 4 independently timed circuits. Each clock shall have a manual scheduling keypad and an alphanumeric display of all timing parameters. Timing parameters shall include: date in Gregorian calendar for month, day and day-of-month indication; and 24-hour time-of-day display, with one-minute resolution for programming the ON and OFF times for each circuit. Each clock shall allow programming of each circuit for 12 holiday periods for either ON or OFF events for any selected duration of the 365-day program. Each clock shall have capacity for programming 4 ON events and 4 OFF events per day for each circuit. The programmed events shall be assignable to a 365-day schedule. Each clock shall have automatic Standard Time and Daylight Saving Time adjustment, by input of the appropriate dates. Each time clock shall have automatic leap year correction. Each clock shall be provided with 4-day battery backup. Power consumption shall not be greater than 10 watts.

2.13.5 Current-to-Pneumatic (IP) Transducers

The transducers shall be 2-wire current-to-pressure transmitters that convert a 4-to-20 mAdc input signal to a 3 to 15 psig, or a 15 to 3 psig, pneumatic output, with a conversion accuracy of plus or minus 2 percent of full scale, including linearity and hysteresis. Input impedance shall not exceed 250 ohms. Air consumption shall not be greater than 0.25 scfm.

2.13.6 Direct Current (DC) Power Supply

One DC power supply shall be used to power all transmitters connected to the control panel. The power supply shall be 24 Vdc at not less than 1.2 amperes, with a peak-to-peak ripple not to exceed 0.03 percent of output voltage. Each power supply shall have a fused input, and shall be protected from voltage surges and powerline transients. The power supply output shall be protected against overvoltage and short circuits.

2.14 PILOT LIGHTS AND MANUAL SWITCHES

Pilot lights and switches shall be rectangular devices arranged in a horizontal matrix as shown. Momentary switches shall be non-illuminated. Interlocking switches shall have separately illuminated sections. Split legend lights shall have separately illuminated sections. Device illumination shall be by light-emitting diode or neon lamp.

2.15 HVAC SYSTEM CONTROL PANELS

2.15.1 Panel Assembly

The control panel shall be factory assembled and shipped to the job site as a single unit. The panel shall be fabricated as shown, and the devices shall be mounted as shown. Each panel shall be fabricated as a bottom-entry connection point for control-system electric power, control-system main air source, control-system wiring, pneumatic tubing, interconnection of control systems, interconnection of starters and external shutdown devices, and energy monitoring and control systems (EMCS) interface. Each panel shall have an operating temperature rise of not greater than 20 degrees F above an ambient temperature of 100 degrees F.

2.15.2 Panel Electrical Requirements

Each control panel shall be powered by nominal 120 volts ac, fused at 5 amps, terminating at the panel on terminal blocks. Instrument cases shall be grounded. Interior panel, interior door, and exterior panel enclosure shall be grounded.

2.15.3 Enclosure

The enclosure for each panel shall be a NEMA 12 single-door wall-mounted box conforming to \-NEMA 250-\, with continuous hinged and gasketed exterior door with print pocket and key lock, continuous hinged interior door, interior back panel, and ventilation louvers in back surface as shown. Inside finish shall be white enamel, and outside finish shall be gray primer over phosphatized surfaces.

2.15.4 Mounting and Labeling

Controllers, pilot lights, switches, IP's, and pressure gauge shall be mounted on the interior door as shown. Power conditioner, fuses and duplex outlet shall be mounted on the interior of the cabinet as shown. All other components housed in the panel shall be mounted on the interior back panel surface of the enclosure, behind the door on rails as shown. Controllers and gauges mounted on the front of the inner door shall be identified by a plastic or metal nameplate as shown that is mechanically attached to the panel. Function modules, relays, timeclocks, IP transducers, DC power supply, and other devices interior to the panel shall be identified by a plastic or metal nameplate that is mechanically attached to the panel. The nameplate shall have the inscription as shown. Lettering shall be cut or stamped into the nameplate to a depth of not less than 1/64 inch, and shall show a contrasting color, produced by filling with enamel or lacquer or by the use of a laminated material. Painting of lettering directly on the surface of the interior door or panel is not permitted.

2.15.5 Wiring and Tubing

2.15.5.1 Current-to-Pneumatic Transducers (IP)

Current-to-pneumatic transducers (IP) shall be piped to bulkhead fittings in the bottom of the panel with a 2 inch loop to accommodate IP replacement and shall be wired to identified terminal blocks.

2.15.5.2 PaneL Wiring

Interconnections Wiring shall be installed in wiring ducts in such a way that devices can be added or replaced without disturbing wiring that is not affected by the change. Wiring to all devices shall have a 4 inch wiring loop in the horizontal wiring duct at each wiring connection. There shall be no wiring splices within the control panel. All interconnections required for power or signals shall be made on device terminals or panel terminal blocks, with not more than two wires connected to a terminal.

2.15.5.3 Panel Terminal Blocks

Terminal blocks shall be arranged in groups as shown. Instrument signal grounds at the same ground reference level shall end at a grounding terminal for connection to a common ground point. Wiring-shield grounds at the same reference level shall end at a grounding terminal for connection to a common ground point. Grounding terminal blocks shall be identified by reference level.

2.15.5.4 Wiring Identification

All wiring connected to controllers, time clocks and function modules shall be identified by function and polarity with full word identifiers, i.e., process variable input, remote setpoint input and control output.

2.15.6 EMCS Terminal Blocks

Terminal blocks shall be provided for connections to EMCS as shown. Analog signals shall require only the removal of jumpers to interface to EMCS.

2.16 COMPRESSED-AIR STATIONS

2.16.1 Air-Compressor Assembly

The air compressor shall be a high-pressure compressing unit with electric motor. The compressor shall be equipped with a motor with totally enclosed belt guard, an operating-pressure switch, safety-relief valves, gauges, intake filter and intake silencer, and combination type magnetic starter with undervoltage protection and thermal-overload protection for each phase, and shall be supported by a steel base mounted on an air storage tank. The air compressor shall provide the compressed air required for control operation while operating not more than one-third of the time. The air storage tank shall be fabricated for a working pressure of not less than 200 psig, and constructed and certified in accordance with \-ASME BPV VIII Div 1-\. The tank shall be of sufficient volume so that no more than six compressor starts per hour are required with the starting pressure switch differential set at 20 psig. The tank shall be provided with an

automatic condensate drain trap with manual override feature. [A second (duplex arrangement) compressor of capacity equal to the primary compressor shall be provided, with interlocked control to provide automatic changeover upon malfunction or failure of either compressor. A manual selector switch shall be provided to index the lead compressor including the automatic changeover].

2.16.2 Compressed-Air Station Specialties

2.16.2.1 Refrigerated Dryer, Filters and, Pressure Regulator

A refrigerated dryer shall be provided in the air outlet line of the air storage tank. The dryer shall be of the size required for the full delivery capacity of the compressor. The air shall be dried at a pressure of not less than 70 psig to a temperature not greater than 35 degrees F. The dryer shall be provided with an automatic condensate drain trap with manual override feature. The refrigerant used in the dryer shall be one of the fluorocarbon gases and have an Ozone Depletion Potential of not more than 0.05. A 5 micron prefilter and coalescing-type 0.03 micron oil removal filter with shut-off valves shall be provided in the dryer discharge. Each filter bowl shall be rated for 150 psig maximum working pressure. A pressure regulator, with high side and low side pressure gauges, and a safety valve shall be provided downstream of the filter. Pressure regulators of the relieving type shall not be used.

2.16.2.2 Flexible Pipe Connections

The flexible pipe connectors shall be designed for 150 psig and 250 degrees F service, and shall be constructed of rubber, tetrafluoroethylene resin, or braided corrosion-resistant steel, bronze, monel, or galvanized steel. The connectors shall be suitable for the service intended and may have threaded or soldered ends. The length of the connectors shall be as recommended by the manufacturer for the service intended.

2.16.2.3 Vibration-Isolation Units

The vibration-isolation units shall be standard products with published loading ratings, and shall be single rubber-in-shear, double rubber-in-shear, or spring type.

2.16.2.4 Compressed Air Piping

Control air delivered to the system shall conform to \-ISA S7.3-\. Air lines for pneumatic controls shall be seamless copper tubing or nonmetallic tubing. Copper tubing shall be hard-drawn in exposed areas and either hard-drawn or annealed in concealed areas. Only tool-made bands shall be used. Fittings for copper tubing shall be brass or copper solder joint type except at connections to apparatus, where fittings shall be brass compression type. Nonmetallic tubing shall be compounded from polyethylene, meeting the stress crack test of \-ASTM D 1693-\. Nonmetallic individual tube polyethylene or multitube instrument tubing bundle shall be classified as flame retardant under \-UL 94-\. The polyethylene material shall be rated as self-extinguishing when tested in accordance with \-ASTM D 635-\. Air lines concealed in walls shall be hard-drawn copper tubing or nonmetallic tubing in rigid conduit. Terminal

single lines shall be hard-drawn copper tubing, except when the run is less than 12 inches in length, flexible polyethylene may be used. Nonmetallic tubing will not be used for applications where the tubing could be subjected to a temperature exceeding 130 degrees F. Fittings for nonmetallic tubing shall be for instrument service and may be brass or acetal resin of the compression or barbed push-on type.

2.17 ELECTRONIC VARIABLE AIR VOLUME (VAV) TERMINAL UNIT CONTROLS

2.17.1 VAV Terminal Units

The VAV terminal units shall be as specified in Section \=15895=\ AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM. All VAV terminal box controllers associated with an AHU shall be networked together such that configuration parameters for any controller may be monitored and modified from the controller of any other terminal unit served by the same AHU.

2.17.2 Terminal-Unit Controls

2.17.2.1 Box Control Device

Controls for pressure independent boxes shall consist of an electronic velocity-sensing device in the primary air entering the box, a room temperature sensing element, a jack for connection of hand held electronic programming and communication, an electronic damper actuator, a 24v electric two position hydronic valve, (Cv=1), , and an adjustable microprocessor-based VAV box controller. Each controller shall operate a damper for cooling and heating and a duct coil for heating. Terminal unit controls shall meet the requirements of \-UL 916-\ and \-47 CFR 15-\.

2.17.2.2 Communication and Programming Device

One hand-held communication and programming device with instruction manual, plus one additional hand-held communicating device and instruction manual per 100 terminal units, shall be provided. The communication and programming device shall connect to the controller directly or to a jack at the room-temperature-sensing element location. The communication and programming device shall be used to read and set minimum velocity, maximum velocity, heating setpoint, and cooling setpoint, and to read velocity and space temperature. All VAV electronic controllers shall be interconnected to provide for reading and communicating to any VAV terminal units control sensors and controller from any thermostat or communications jack on AHU system. If the units will not interconnect, run a separate remote jack for wach VAV terminal unit to the mechanical room on that wing and terminate hese within a separate control panel.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION CRITERIA

The HVAC control system shall be installed and ready for operation, as specified and shown. Dielectric isolation shall be provided where dissimilar metals are used for connection and support. Penetrations

through and mounting holes in the building exterior shall be made watertight. The HVAC control system installation shall provide clearance for control system maintenance by maintaining access space between coils, access space to mixed-air plenums, and other access space required to calibrate, remove, repair, or replace control system devices. The control system installation shall not interfere with the clearance requirements for mechanical installation shall not interfere with the clearance requirements for mechanical and electrical system maintenance.

3.1.1 Device Mounting Criteria

Devices mounted in or on piping or ductwork, on building surfaces, in mechanical/electrical spaces, or in occupied space ceilings shall be installed in accordance with manufacturer's recommendations and as shown. Control devices to be installed in piping and ductwork shall be provided with all required gaskets, flanges, thermal compounds, insulation, piping, fittings, and manual valves for shutoff, equalization, purging, and calibration. Strap-on temperature sensing elements shall not be used except as specified.

3.1.2 Wiring Criteria

[AM#1]

Wiring external to control panels, including low-voltage wiring, shall be installed in metallic raceways. _____ Wiring shall be installed without splices between control devices and HVAC control panels. Cables and conductors shall be tagged at both ends, with the identifier shown on the shop drawings, in accordance with the requirements of Section \=16415=\ ELECTRICAL WORK, INTERIOR. Other electrical work shall be as specified in Section \=16415=\ ELECTRICAL WORK, INTERIOR and as shown.

3.1.2.1 Power-Line Surge Protection

Equipment connected to ac circuits shall be protected from powerline surges. Equipment protection shall meet the requirements of \-IEEE C62.41-\. Fuses shall not be used for surge protection.

3.1.2.2 Controller Output Loop Impedance Limitation

Controller output loops shall be constructed so that total circuit impedance connected to the analog output of a single-loop controller shall not exceed 600 ohms.

3.2 CONTROL SYSTEM INSTALLATION

3.2.1 Damper Actuators

Actuators shall not be mounted in the air stream. Multiple actuators operating a common damper shall be connected to a common drive shaft. Actuators shall be installed so that their action shall seal the damper to the extent required to maintain leakage at or below the specified rate and shall move the blades smoothly.

3.2.2 Local Gauges for Actuators

Pneumatic actuators shall have an accessible and visible receiver gauge installed in the tubing lines at the actuator as shown.

3.2.3 Room-Instrument Mounting

Room instruments shall be mounted so that their sensing elements are 5 feet above the finished floor unless otherwise shown. Temperature setpoint device shall be recess mounted.

3.2.4 Smoke Detectors

Duct smoke detectors shall be provided in supply and return air ducts in accordance with \-NFPA 90A-\.

3.2.5 Manual Emergency Fan Shutdown Switches

Manual emergency fan shutdown switches shall be provided for air distribution fans in accordance with \-NFPA 90A-\. Switches shall be the manual-reset type. Switches shall be located and mounted in an accessible manner, approximately 48 inches above the finished floor. Switches shall be properly identified in etched rigid plastic placards.

3.2.6 Low-Temperature-Protection Thermostats

For each 20 square feet of coil-face area, or fraction thereof, a thermostat shall be provided to sense the temperature at the location shown. The thermostat sensing element shall be installed in a serpentine pattern.

3.2.7 Averaging-Temperature Sensing Elements

Sensing elements shall have a total-element minimum length equal to one linear foot per square foot of duct cross-sectional area.

3.2.8 Foundations and Housekeeping Pads

Foundations and housekeeping pads shall be provided for the HVAC control system air compressors.

3.2.9 Compressed-Air Stations

The air-compressor assembly shall be mounted on vibration eliminators, in accordance with \-ASME BPV VIII Div 1-\ for tank clearance. The air line shall be connected to the tank with a flexible pipe connector. Compressed-air-station specialties shall be installed with all required tubing, including condensate tubing to a floor drain.

3.2.10 Duct Static-Pressure Sensing Elements and Transmitters

The duct static-pressure sensing element and transmitter sensing point shall be located at 75% to 100% of the distance between the first and last air terminal units.

3.2.11 Indication Devices Installed in Piping and Liquid Systems

Gauges in piping systems subject to pulsation shall have snubbers. Gauges for steam service shall have pigtail fittings with cock. Thermometers and temperature sensing elements installed in liquid systems shall be installed in thermowells.

3.2.12 Control System Tubing

The control system shall be installed so that pneumatic lines are not exposed to outside-air temperatures. Air lines shall be concealed except in mechanical rooms and other areas where other tubing and piping is exposed. All tubes and tube bundles exposed to view shall be installed neatly in lines parallel to the lines of the building. Tubing between panels and actuators in mechanical/electrical spaces shall be routed so that the lines are easily traceable. Air lines shall be tested periodically for leaks during installation. Air lines shall be purged of dirt, impurities and moisture before connecting to the control equipment. Air lines shall be number coded or color coded and keyed to the submittal drawings for future identification and servicing the control system.

3.2.12.1 Pneumatic Lines In Mechanical/Electrical Spaces

In mechanical/electrical spaces, pneumatic lines shall be plastic tubing or copper tubing. Horizontal and vertical runs of plastic tubes or soft copper tubes shall be installed in raceways dedicated to tubing. The dedicated raceways shall be supported every 6 feet for horizontal runs and every 8 feet for vertical runs. Tubing not installed in raceways shall be hard-drawn copper tubing with sweat fittings and valves, supported every 6 feet for horizontal runs and every 8 feet for vertical runs.

3.2.12.2 Pneumatic Lines External To Mechanical/Electrical Spaces

Tubing external to mechanical/electrical spaces, when run in plenum ceilings, shall be soft copper with sweat fittings, supported every 8 feet. Tubing not in plenum spaces shall be soft copper with sweat fittings supported every 8 feet or shall be plastic tubing in raceways dedicated to tubing.

3.2.12.3 Connection to Liquid and Steam Lines

Tubing for connection of sensing elements and transmitters to liquid and steam lines shall be copper brass compression fittings.

3.2.12.4 Connection to Ductwork

Tubing for connection of sensing elements and transmitters to ductwork shall be plastic tubing.

3.2.12.5 Tubing in Concrete

Tubing in concrete shall be installed in rigid conduit. Tubing in walls containing insulation, fill, or other packing materials shall be installed in raceways dedicated to tubing.

3.2.12.6 Final Connection to Actuators

Final connections to actuators shall be plastic tubing 12 inches long and unsupported at the actuator.

3.2.12.7 Connection to HVAC Control Panel

A manual valve shall be provided at each HVAC control panel to allow shutoff of main air. Pneumatic connections to HVAC control panels shall be made at bulkhead fittings. Final connections to HVAC control panel bulkhead fitting shall be exposed tubing approximately 12 inches long.

3.3 CONTROL SEQUENCES OF OPERATION

3.3.1 System Requirements

These requirements shall apply to all primary HVAC systems unless modified herein. The sequences describe the actions of the control system for one direction of change in the HVAC process analog variable, such as temperature, humidity or pressure. The reverse sequence shall occur when the direction of change is reversed.

3.3.1.1 HVAC System Supply Fan Operating

HVAC system outside-air, return-air, and relief-air dampers shall function as described hereinafter for specific modes of operation . [Interlocked exhaust fans shall be stopped in the unoccupied and ventilation delay modes and their dampers shall be closed. Interlocked exhaust fans shall run in the occupied mode, and their dampers shall open.] Cooling-coil control valves [and cooling-coil circulating pumps] shall function as described hereinafter for the specific modes of operation [unless their control is assumed by the freeze-protection system]. Heating coil valves shall be under control.

3.3.1.2 HVAC System Supply Fan Not Operating

When an HVAC system is stopped, the outside-air and relief-air dampers shall close, the return-air damper shall open cooling-coil valves for coils located indoors shall close to the coil. Cooling-coil valves of units located outdoors shall open to the coil. Heating-coil valves shall remain under control.

3.3.1.3 HVAC System Hydronic Heating Distribution Pump Operation

Hydronic heat-exchanger valves shall be under control.

3.3.1.4 HVAC System Hydronic Heating Distribution Pump Not Operating

Hydronic heat-exchanger valves shall close.

3.3.2 Unit-Heater and Cabinet-Unit-Heater

A wall-mounted thermostat with an "AUTO-OFF" switch located as shown, shall cycle the fan to maintain its setpoint as shown when the switch is in the "AUTO" position. When the switch is in the "OFF" position, the fan shall be stopped.

3.3.3 All-Air Small Package Unitary System

A microprocessor-based room thermostat, located as shown, with "HEAT-OFF-COOL" and "AUTO-ON" switches shall control the system. When the switch is in the "HEATING" position, the cooling unit shall be off, and heating shall be active. The thermostat shall operate the condensing unit and system fan to maintain the day and night setpoints as shown. Programmed occupied times shall be considered "day" and programmed unoccupied times shall be considered "night." When the switch is in the "COOLING" position, the heating unit shall be off. The thermostat shall operate the condensing units and system fan to maintain the setpoint as shown during the day. The condensing unit shall be off at night. When the switch is in the "OFF" position, the system shall be off. When the "AUTO-ON" switch is in the "ON" position, the system fan shall run continuously. In the "AUTO" position, the system fan shall operate whenever heating or cooling is required.

Dual-Temperature Fan-Coil Unit

3.3.4 Variable-Air-Volume Control Sequence without Return Fan

3.3.4.1 Occupied, Unoccupied, and Ventilation-Delay Modes

Ventilation-delay mode timing shall start prior to the occupied-mode timing. The timeclock shall close a contact, which shall turn on the ventilation-delay pilot light and energize a relay which shall prevent the outside-air damper from opening. At the time shown, the timeclock shall close a contact which shall turn on the occupied-mode pilot light and shall place the system in the occupied mode. At the expiration of the ventilation-delay-mode timing period, the timeclock shall open the contact to turn off the ventilation-delay-mode pilot light and de-energize a relay to allow the outside-air damper to open. At the time shown, the timeclock shall open the contact to turn off the occupied-mode pilot light and shall place the control system in the unoccupied mode of operation.

3.3.4.2 Outside-Air, Return-Air, and Relief-Air Dampers

a. Occupied Mode - The outside-air, return-air, and relief-air dampers shall be under mixed-air temperature and economizer control.

b. Unoccupied and Ventilation-Delay Modes - The dampers shall return to their normal positions.

3.3.4.3 Supply-Fan Control

a. Occupied and Ventilation-Delay Modes - Supply fan shall start and shall operate continuously.

b. Unoccupied Mode - The supply fan shall cycle from a night-thermostat located as shown. The fan shall start at and stop at the setpoints as shown.

3.3.4.4 Supply-Duct Pressurization Control

When the supply fan starts, the duct static-pressure controller shall modulate the inlet vanes from the signal of a pressure-sensing element and transmitter to maintain the setpoint as shown. A high-limit static-pressure switch in the fan discharge shall stop the fan and turn on the high-static pilot light when the static pressure exceeds the setpoint. Restarting the supply fan and turning off the pilot light shall require manual reset at the HVAC control panel. When the fan is off, the inlet vane shall be closed.

3.3.4.5 Filter

A differential-pressure switch across the filter shall turn on the filter pilot light when the pressure drop across the filter reaches the setpoint as shown.

3.3.4.6 Freeze Protection

All Modes - A freezestat, located as shown, shall stop the supply fan, cause the outside air, return air, and relief air dampers to return to their normal position as shown, and shall turn on the low-temperature pilot light in the HVAC control panel if the temperature drops below the freezestat's setpoint as shown. Return to the normal mode of operation shall require manual reset [at the freezestat and] at the HVAC control panel.

3.3.4.7 Cooling Coil

a. Occupied and Ventilation-Delay Modes - The control valve shall be modulated by the cooling-coil temperature controller from the signal of a temperature-sensing element and transmitter located in the coil discharge air to maintain the setpoint as shown.

b. Unoccupied Mode - The cooling-coil temperature-controller output signal shall be interrupted and the cooling-coil control valve shall be closed.

3.3.4.8 Constant Outside Air Flow Control:

The outside air duct has a multi point electronic array flow station which provides the flow signal to the flow controller FC-01 which shall modulate the outside air ventilation damper and the return air damper to achieve a constant setpoint of outside air into the building for indoor air quality needs.

3.3.4.9 Economizer Control

An economizer controller shall accept the signal of an outside-air temperature-sensing element and transmitter at its remote setpoint input

and shall accept the signal of a return-air temperature-sensing element and transmitter at its process variable input. The economizer controller shall perform switchover between outside-air economizer control mode and minimum outside-air mode. Until the return-air temperature rises above the setpoint as shown, the economizer controller shall hold the system in the minimum-outside-air mode and the economizer pilot light shall be off. When the return-air temperature rises above the setpoint, the economizer controller shall place the control system in the economizer mode or in the minimum-outside-air mode as determined by a comparison of the outside-air and return-air temperatures in accordance with the differential temperature setpoints as shown. When the outside-air temperature is low with respect to the return-air temperature, the control system shall be in the economizer mode and the economizer pilot light shall be on. When the economizer controller places the control system in the minimum-outside-air mode, the outside-air damper shall be open to the setting determined by the minimum-position switch.

3.3.4.10 Mixed-Air Temperature Control

When the economizer controller places the system in the economizer mode, the mixed-air temperature controller shall modulate the dampers from the signal of a temperature-sensing element and transmitter located in the mixed-air stream to maintain the setpoint as shown.

3.3.4.11 Pressure-Independent Terminal VAV Box

All Modes - The control damper of the VAV box shall modulate in response to the signal from a flow-sensing element at the discharge or inlet of the VAV box to a microprocessor-based VAV-box velocity controller. The velocity controller shall control the box damper from the minimum-flow position to the full-flow position from the signal of a space-temperature sensing element located as shown. When the space temperature decreases, the damper shall gradually close to the minimum-flow position to maintain the cooling setpoint as shown. When the space temperature calls for heating after the minimum-flow position is reached, control shall then pass through a temperature dead band as shown. When the space temperature has dropped through the dead band, the duct heater coil shall be gradually controlled to maintain the heating setpoint as shown.

3.4 COMMISSIONING PROCEDURES

3.4.1 General Procedures

3.4.1.1 Evaluations

The Contractor shall make the observations, adjustments, calibrations, measurements, and tests of the control systems, tune the controllers, set the timeclock schedule, and make any necessary control-system corrections to ensure that the systems function as described in paragraph CONTROL SEQUENCES OF OPERATION. The Contractor shall permanently record, on system equipment schedule, the final setting of controller proportional, integral and derivative constant settings, setpoint, manual reset setting, maximum and minimum controller output, and ratio and bias settings, in units and terminology specific to the controller.

3.4.1.2 Item Check

An item-by-item check of the sequence of operation requirement shall be performed using Steps 1 through 4 in the specified control system commissioning procedures. Steps 1, 2, and 3 shall be performed with the HVAC system shutdown; Step 4 shall be performed after the HVAC systems have been started. Signals used to change the mode of operation shall originate from the actual HVAC control device intended for the purpose, such as the time clock. External input signals to the HVAC control panel (such as EMCS, starter auxiliary contacts, and external systems) may be simulated in Steps 1, 2, and 3. With each operational-mode change signal, pilot lights and HVAC-panel output-relay contacts shall be observed to ensure that they function. All terminals assigned to EMCS shall be checked and observed to ensure that the proper signals are available.

3.4.1.3 Weather-Dependent Test Procedures

Weather-dependent test procedures that cannot be performed by simulation shall be performed in the appropriate climatic season. When simulation is used, the Contractor shall verify the actual results in the appropriate season.

3.4.1.4 Configuration

The Contractor shall configure each controller for its specified service.

3.4.1.5 Two-Point Accuracy Check

A two-point accuracy check of the calibration of each HVAC-control-system sensing element and transmitter shall be performed by comparing the HVAC-control-panel readout to the actual value of the variable measured at the sensing element and transmitter or airflow measurement station location. Digital indicating test instruments shall be used, such as digital thermometers, motor-driven psychrometers, and tachometers. The test instruments shall be at least twice as accurate as the specified sensing element-to-controller readout accuracy. The calibration of the test instruments shall be traceable to NIST standards. The first check point shall be with the HVAC system in the shutdown condition, and the second check point shall be with the HVAC system in an operational condition. Calibration checks shall verify that the sensing element-to-controller readout accuracies at two points are within the specified product accuracy tolerances. If not, the device shall be recalibrated or replaced and the calibration check repeated.

3.4.1.6 Insertion, Immersion Temperature

Insertion-temperature and immersion-temperature sensing element and transmitter-to-controller readout calibration accuracy shall be checked at one physical location along the axis of the sensing element.

3.4.1.7 Averaging Temperature

Averaging-temperature sensing element and transmitter-to-controller readout calibration accuracy shall be checked every 2 feet along the axis of the sensing element in the proximity of the sensing element, for a maximum of 10 readings. These readings shall then be averaged.

3.4.1.8 Controller Stations

The Contractor shall use the controllers' MANUAL/AUTOMATIC stations as the means of manipulating control devices, such as dampers and valves, to check IP operation and to effect stable conditions prior to making measurement checks.

3.4.1.9 Controller-Tuning Procedure

The Contractor shall perform a controller-tuning procedure, which shall consist of setting the initial proportional, integral, and derivative (PID) mode constants, controller setpoints, and logging the settings. Tuning shall be self-tuning operation by the controller unless manual tuning is necessary.

3.4.1.10 Controller Manual-Tuning Procedure

Where required, the controller manual-tuning procedure shall be performed in three steps. Using a constant-temperature-setpoint controller as an example, these steps are:

a. Step A:

<ITM>(1) The controller MANUAL/AUTO station shall be indexed to the AUTO position and the integral- and derivative-mode constants set to zero.

<ITM>(2) The proportional-mode constant shall be set to an initial setting of 8 percent. (This corresponds to 1.5 psig per degree F or 2.0 ma per degree F proportional controller output change for a 100 degree F transmitter span.) This causes the controller output signal to vary from live zero output to full output for an input signal change representing an 8 degree F change.

<ITM>(3) Controllers for other variables, such as relative humidity and static pressure, shall have their proportional-mode constants set initially in a similar manner for an achievable output range proportional to the transmitter span.

b. Step B:

<ITM>(1) The controller temperature setpoint shall be set at any achievable temperature. The controller output and transmitter input shall be observed.

<ITM>(2) If the transmitter input continuously oscillates above and below the setpoint without settling at a fixed value, or if such oscillation increases, the proportional-mode constant is too small.

<ITM>(3) If the proportional-mode constant is too small, increase it in steps until the transmitter input indicates stable control at any temperature, provided that the controller output is not at either extreme of the output range.

<ITM>(4) If the temperature control point slowly drifts toward or away from the controller setpoint, the proportional-mode constant is too large. Its setting shall be decreased in steps until oscillations occur as

described in the preceding paragraphs, and then the setting shall be increased until stable control occurs.

<ITM>(5) A step change in controller setpoint shall be introduced. This should cause the controller to overshoot the setpoint slightly, with each subsequent overshoot peak value decreasing by a factor of 2/3 until stable control is achieved at, above, or below the setpoint.

<ITM>(6) Next, the integral-mode constant setting shall be increased in small steps, and setpoint changes shall be introduced until control point and controller setpoint coincide at stable control. This should happen consistently after a setpoint change within a short time, such as 5 to 10 minutes.

c. Step C:

<ITM>(1) Unless the HVAC process variable changes rapidly, the derivative-mode constant setting can remain at zero.

<ITM>(2) If derivative control is needed, the derivative-mode constant shall be gradually increased.

<ITM>(3) Step changes in controller setpoint shall be introduced, and the derivative-mode constant setting adjusted until stable control is achieved.

3.4.1.11 Setting the Controller

After the controller manual-tuning procedure is complete, the controller shall be set at the setpoint as shown.

3.4.2 Unit Heater and Cabinet Unit Heater

The "OFF/AUTO" switch shall be placed in the "OFF" position. Each space-thermostat temperature setting shall be turned up so that it makes contact to turn on the unit-heater fans. The unit-heater fans shall not start. The "OFF/AUTO" switch shall be placed in the "AUTO" position. The unit-heater fans shall start. Each space-thermostat temperature setting shall be turned down, and the unit-heater fans shall stop. The thermostats shall be set at their temperature setpoints as shown. The results of testing of one of each type of unit shall be logged.

3.4.3 All-Air Small Packaged Unitary

The schedules shall be manually entered for day-temperature and night-temperature setpoints as shown. The fan "AUTO/ON" switch shall be set to "ON". The time shall be manually entered as "DAY". The heating-cooling switch shall be raised to "HEATING" and cooling shall be off. The temperature setpoint shall be raised and heating shall start. The heating/cooling switch shall be set to "COOLING" and heat shall be off. The temperature setpoint shall be lowered and cooling shall start. The fan "AUTO/ON" switch shall be set to "AUTO" and the foregoing procedure repeated. The fan shall start and stop automatically with the starting and stopping of heating and cooling. The time shall be manually entered as

"NIGHT". The foregoing procedures shall be repeated. When the system is verified as operational, the correct "DAY" and "NIGHT" temperature settings shall be restored and the correct time restored. The power to the thermostat shall be shut off and it shall be verified that the thermostat clock keeps time. The results of testing of one of each type of unit shall be logged.

3.4.4 Variable-Air-Volume, Without Return Fan

Steps for installation shall be as follows:

a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. Power and main air shall be available at the HVAC system control panel. The outside-air and relief-air dampers shall be closed, the return-air damper open, and the supply-fan inlet vanes and cooling-coil valve shall be closed.

b. Step 2 - Calibration Accuracy Check with HVAC System in Shutdown: Readings shall be taken with a digital thermometer at each temperature-sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air, return-air, mixed-air, and the cooling-coil discharge air temperatures shall be checked.

c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator, using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all dampers and valves shall be verified. The signal shall be varied from live zero of 4 ma [or 3 psig] to 20 ma [or 15 psig], and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced and parallel-operated actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other.

d. Step 4 - Control-System Commissioning:

<ITM>(1) With the fan ready to start, the ventilation-delay-mode signal shall be applied, and it shall be verified that the ventilation-delay mode pilot light turns on. The occupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns on and that supply fan [_____] starts. It shall be verified that the outside-air and relief-air dampers are closed, the return-air damper is open, and the cooling-coil valve and inlet vanes are under control, by slightly changing the controller output. The ventilation-delay-mode signal shall be released, and it shall be verified that the ventilation-delay-mode pilot light turns off and that the outside-air, return-air, and relief-air dampers come under control, by changing the controller output.

<ITM>(2) The minimum-outside-air-mode signal shall be applied. It shall be verified that the outside-air damper opens to minimum position and that the economizer pilot light is off.

<ITM>(3) With supply fan running, a high static-pressure input signal shall be simulated at the device, by pressure input to the

differential-pressure switch sensing device. HVAC system shutdown shall be observed. It shall be verified that the high-static-pressure pilot light turns on, and that contact output at the EMCS terminals is made. The differential-pressure switch shall be set at the setpoint as shown. The HVAC system shall be restarted by manual restart, and it shall be verified that the high-static-pressure pilot light turns off.

<ITM>(4) The supply-fan static-pressure controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the two-point calibration accuracy check for sensing element-to-controller readout shall be performed. The controller shall be placed in the local setpoint mode. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller-tuning procedure performed. The controller shall be set at the static-pressure setpoint as shown, and the mode-constants logged.

<ITM>(5) The mixed-air temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position. An economizer-mode input signal shall be simulated and it shall be verified that the economizer-mode pilot light turns on. The mixed-air temperature controller output shall be changed to slightly open the outside-air damper and the second point of the two-point calibration accuracy check of sensing element-to-controller readout for outside-air, return-air, and mixed-air temperatures shall be performed. The controller-tuning procedure shall be performed. The mixed-air temperature controller "MANUAL/AUTO" switch shall be indexed to the "AUTO" position. The mixed-air temperature controller shall be placed in the local setpoint mode and set at the temperature setpoint as shown.

<ITM>(6) The cooling coil temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the calibration accuracy check of sensing element-to-controller readout shall be performed. The controller shall be placed in the local-setpoint mode, and set at the temperature setpoint as shown. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller-tuning procedure performed.

<ITM>(7) An unoccupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns off, the HVAC system shuts down, and the control system assumes the specified shutdown conditions. The night-thermostat temperature setting shall be turned upward, and it shall be verified that the HVAC system starts; the setting shall be turned downward, and it shall be verified that the HVAC system stops. The night thermostat shall be set at the setpoint as shown.

<ITM>(8) With the HVAC system running, a filter differential-pressure-switch input signal shall be simulated at the device. It shall be verified that the filter pilot light turns on, and that contact output at the EMCS terminals is made. The differential-pressure switch shall be set at the setpoint as shown.

<ITM>(9) With the HVAC system running, a freezestat trip input signal shall be simulated at the device. HVAC system shutdown shall be observed. It shall be verified that the low-temperature pilot light turns on, and that contact output at the EMCS terminals is made. The freezestat shall be set at the setpoint as shown. The HVAC system shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

<ITM>(10) With the HVAC system running, a smoke-detector trip input signal shall be simulated at each detector, and control-device actions and interlock functions, as described in paragraph CONTROL SEQUENCES OF OPERATION shall be verified. Simulation shall be performed without false-alarming any Life Safety systems. It shall be verified that the HVAC system shuts down and that the smoke-detector pilot light turns on, and contact output at the EMCS terminals is made. The detectors shall be reset. The HVAC system shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

<ITM>(11) Velocity setpoints for minimum and maximum flow and temperature setpoints for the heating/cooling dead band shall be set, for each VAV terminal unit. The actions of the controller, the operation of the damper, and the operation of heating shall be verified. It shall be verified that space temperature is maintained.

3.4.5 Variable-Air-Volume Control

System with Return Fan Steps for installation shall be as follows:

a. Step 1 - System Inspection: The HVAC system shall be observed in its shutdown condition. Power and main air shall be available at the HVAC system control panel. The outside-air and relief-air dampers shall be closed, the return-air damper open, and the inlet vanes and cooling-coil valve shall be closed.

b. Step 2 - Calibration Accuracy Check with HVAC System Shutdown: Readings shall be taken with a digital thermometer at each temperature sensing element location. Each controller display shall be read, and the thermometer and controller-display readings logged. The calibration accuracy of the sensing element-to-controller readout for outside-air, return-air, mixed-air, and cooling-coil discharge-air temperatures shall be checked. The supply-airflow and return-airflow shall be read, using a digital indicating velometer, and the velometer and controller-display readings logged. The flows shall read zero.

c. Step 3 - Actuator Range Adjustments: A signal shall be applied to the actuator, using the controller "MANUAL/AUTO" station in "MANUAL." The proper operation of the actuators and positioners for all dampers and valves shall be verified. The signal shall be varied from live zero of 4 ma [or 3 psig] to 20 ma [or 15 psig], and it shall be verified that the actuators travel from zero stroke to full stroke within the signal range. It shall be verified that all sequenced and parallel-operated actuators move from zero stroke to full stroke in the proper direction, and move the connected device in the proper direction from one extreme position to the other.

d. Step 4 - Control-System Commissioning:

<ITM>(1) With the fans ready to start, the ventilation-delay-mode signal shall be applied, and it shall be verified that the ventilation-delay mode pilot light turns on. The occupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns on and that supply fan starts. It shall be verified that the outside-air and relief-air dampers are closed, the return-air damper is open, and the cooling-coil valve and inlet vanes are under control, by slightly changing the controller output. The ventilation-delay-mode signal shall be

released, and it shall be verified that the ventilation-delay-mode pilot light turns off and that the outside-air, return-air and relief-air dampers come under control by changing the controller output.

<ITM>(2) The constant-outside-air-mode control signal shall be applied. It shall be verified that the ventilation outside-air damper and return air damper modulate to achiev flow controller setpoint cfm and that the economizer pilot light is off.

<ITM>(3) With supply fan running, a high-static-pressure input signal shall be simulated at the device, by pressure input to the differential-pressure switch sensing device. HVAC system shutdown shall be observed. It shall be verified that the high-static pilot light turns on, and that contact output at the EMCS terminals is made. The differential-pressure switch shall be set at the setpoint as shown. The HVAC system shall be restarted by manual restart, and it shall be verified that the high-static-pressure pilot light turns off.

<ITM>(4) The supply-fan static-pressure controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the two-point calibration accuracy check for sensing element-to-controller readout shall be performed. The controller shall be placed in the local setpoint mode. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller-tuning procedure performed. The controller shall be set at the static-pressure setpoint, and the mode-constants logged.

<ITM>(6) The mixed-air temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position. An economizer-mode input signal shall be simulated and it shall be verified that the economizer-mode pilot light turns on. The mixed-air temperature controller output shall be changed to slightly open the outside-air damper and the second point of the two-point calibration accuracy check of sensing element-to-controller readout for outside-air, return-air, and mixed-air temperatures shall be performed. The controller-tuning procedure shall be performed. The mixed-air temperature controller "MANUAL/AUTO" switch shall be indexed to the "AUTO" position. The mixed-air temperature controller shall be placed in the local setpoint mode and set at the temperature setpoint as shown.

<ITM>(7) The cooling coil temperature controller "MANUAL/AUTO" station shall be indexed to the "MANUAL" position, and the calibration accuracy check of sensing element-to-controller readout shall be performed. The controller shall be placed in the local-setpoint mode, and set at the temperature setpoint as shown. The controller "MANUAL/AUTO" station shall be indexed to the "AUTO" position, and the controller-tuning procedure performed.

<ITM>(8) An unoccupied-mode signal shall be applied, and it shall be verified that the occupied-mode pilot light turns off, the HVAC system shuts down, and the control system assumes the specified shutdown conditions. The night-thermostat temperature setting shall be turned upward, and it shall be verified that the HVAC system starts; the setting shall be turned downward, and it shall be verified that the HVAC system stops. The night thermostat shall be set at the setpoint as shown.

<ITM>(9) With the HVAC system running, a filter differential-pressure switch input signal shall be simulated at the device. It shall be verified that the filter pilot light turns on, and that contact output at the EMCS terminals is made. The differential-pressure switch shall be set at the setpoint as shown.

<ITM>(10) With the HVAC system running, a freezestat trip input signal shall be simulated at the device. HVAC system shall shut down, and contact output at EMCS terminals shall be verified. It shall be verified that the low-temperature pilot light turns on. The freezestat shall be set at the setpoint as shown. The HVAC system shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

<ITM>(11) With the HVAC system running, a smoke-detector trip input signal shall be simulated at each detector and control-device actions and interlock functions, as described in paragraph CONTROL SEQUENCES OF OPERATION shall be verified. Simulation shall be performed without false-alarming any Life Safety systems. It shall be verified that the HVAC system shuts down, that the smoke-detector pilot light turns on, and that contact output at the EMCS terminals is made. The detectors shall be reset. The HVAC system shall be restarted by manual restart, and it shall be verified that the pilot light turns off.

<ITM>(12) For each VAV terminal unit, velocity setpoints shall be set for minimum and maximum flow, and temperature setpoints shall be set for the heating/cooling dead band. The actions of the controller, the operation of the damper, and the operation of heating shall be verified. It shall be verified that space temperature is maintained.

3.5 BALANCING, COMMISSIONING, AND TESTING

3.5.1 Coordination with HVAC System Balancing

Commissioning of the control system, except for tuning of controllers, shall be performed prior to and simultaneous with HVAC system balancing. The Contractor shall tune the HVAC control system after all air-system and hydronic-system balancing has been completed, minimum damper positions set and a report has been issued.

3.5.2 Control System Calibration, Adjustments, and Commissioning

Control system commissioning shall be performed for each HVAC system, using test plans and procedures previously approved by the Government. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform commissioning and testing of the HVAC control system. All instrumentation and controls shall be calibrated and the specified accuracy shall be verified using test equipment with calibration traceable to NIST standards. Wiring shall be tested for continuity and for ground, open, and short circuits. Tubing systems shall be tested for leaks. Mechanical control devices shall be adjusted to operate as specified. HVAC control panels shall be pretested off-site as a functioning assembly ready for field connections, calibration, adjustment, and commissioning of the operational HVAC control system. Written notification of any planned commissioning or testing of the HVAC Control

systems shall be given to the Government at least 14 calendar days in advance.

3.5.3 Performance Verification Test

The Contractor shall demonstrate compliance of the HVAC control system with the contract documents. Using test plans and procedures previously approved by the Government, the Contractor shall demonstrate all physical and functional requirements of the project. The performance verification test shall show, step-by-step, the actions and results demonstrating that the control systems perform in accordance with the sequences of operation. The performance verification test shall not be started until after receipt by the Contractor of written permission by the Government, based on Government approval of the commissioning report and completion of balancing. The tests shall not be conducted during scheduled seasonal off-periods of base heating and cooling systems.

3.5.4 Posted and Panel Instructions

Posted and panel instructions, showing the final installed conditions, shall be provided for each system. The posted instructions shall consist of half-size laminated drawings and shall include the control system schematic, equipment schedule, ladder diagram, sequence of operation, panel arrangement drawings, wiring diagram, and valve and damper schedules. The posted instructions shall be permanently affixed, by mechanical means, to a wall near the control panel. Panel instructions shall consist of laminated letter-size sheets and shall include a routine maintenance checklist and controller configuration check sheets with final configuration record for each controller. Panel instructions and one copy of the operation and maintenance manuals, previously described herein, shall be placed inside each control panel.

3.6 TRAINING

3.6.1 Training-Course Requirements

A training course shall be conducted for _4_ operating staff members designated by the Contracting Officer. The training period, for a total of 32 hours of normal working time, shall be conducted within 30 days after successful completion of the performance verification test. The training course shall be conducted at the project site. Audiovisual equipment and [_____] sets of all other training materials and supplies shall be provided. A training day is defined as 8 hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility.

3.6.2 Training-Course Content

For guidance in planning the required instruction, the Contractor shall assume that attendees will have a high school education or equivalent, and are familiar with HVAC systems. The training course shall cover all of the material contained in the operating and maintenance instructions, the layout and location of each HVAC control panel, the layout of one of each type of unitary equipment and the locations of each, the location of each system-control device external to the panels, the location of the compressed-air station, preventive maintenance, troubleshooting,

diagnostics, calibration, adjustment, commissioning, tuning, and repair procedures. Typical systems and similar systems may be treated as a group, with instruction on the physical layout of one such system. The results of the performance verification test and the calibration, adjustment and commissioning report shall be presented as benchmarks of HVAC control-system performance by which to measure operation and maintenance effectiveness.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 16375

ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

11/92

PART
1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI C12.1-\	\&(1995)&\ Code for Electricity Metering
\-ANSI C12.4-\	(1984; R 1990) Mechanical Demand Registers
\-ANSI C12.10-\	(1987) Electromechanical Watthour Meters
\-ANSI C12.11-\	(1987; R 1993) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV \&BIL&\ (0.6 kV NSV through 69 kV NSV)
\-ANSI C29.1-\	(1988) Electrical Power Insulators - Test Methods
\&\-ANSI C37.16-\	(1988; C37.16a) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations&\
\&\-ANSI C37.46-\	(1981; R 1992) Power Fuses and Fuse Disconnecting Switches&\
\-ANSI C37.50-\	(1989) \&Switchgear,&\ Low-Voltage AC Power Circuit Breakers Used in Enclosures - Test Procedures
\&\-ANSI C37.72-\	(1987) Manually-Operated Dead-Front, Padmounted Switchgear with Load-Interrupting Switches and Separable Connectors for Alternating-Current Systems&\
\-ANSI C37.121-\	(1989) \&Switchgear,&\ Unit Substations Requirements
\-ANSI C57.12.13-\	(1982) Conformance Requirements for Liquid-Filled Transformers Used in Unit Installations, Including Unit Substations
\-ANSI C57.12.21-\	(1980) Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with High-Voltage Bushings; \&(High-Voltage, 34 500 Grd Y/19 920 Volts and Below; Low-Voltage, 240/120; 167 kVA and Smaller)&\
\-ANSI C57.12.26-\	(1993) Pad-Mounted Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVa and Smaller

\-ANSI C57.12.27-\	(1982) Conformance Requirements for Liquid-Filled Distribution Transformers Used in Pad-Mounted Installations, Including Unit Substations
\-ANSI C57.12.28-\	(1988) Switchgear and Transformers - Padmounted Equipment - Enclosure Integrity
\-ANSI C80.1-	**(1990) Rigid Steel Conduit - Zinc Coated**
\-ANSI C119.1-	**(1986) Sealed Insulated Underground Connector Systems Rated 600 Volts**
\-ANSI C135.30-	**(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction**
\-ANSI O5.1-	**(1992) Specifications and Dimensions for Wood Poles**

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 48-	**(1994a) Gray Iron Castings**
\-ASTM A 123-	**(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products**
\-ASTM A 153-	**\&(1996)&\ Zinc Coating (Hot-Dip) on Iron and Steel Hardware**
\-ASTM B 8-	**(1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft**
\-ASTM B 117-	**(1994) Operating Salt Spray (Fog) Testing Apparatus**
\-ASTM C 478-	**(1994) Precast Reinforced Concrete Manhole Sections**
\-ASTM D 923-	**(1991) Sampling Electrical Insulating Liquids**
\-ASTM D 1654-	**(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments**
\&\-ASTM D 2472-	**(1992) Sulfur Hexafluoride&**
\-ASTM D 4059-	**(1991) Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography**
\-ASTM F 883-	**(1990) Padlocks**

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

\-AEIC CS5-	**(1994) Specifications for Cross-linked Polyethylene Insulated Shielded Power Cables Rated 5 Through 46 kV**
\-AEIC CS6-	**(1987; Rev Mar 1989) Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 Through 69 kV**

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

\-FM P7825-	**\&(1995; Supple I; Supple II; Supple III)&\ Approval Guide**

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

\&\-IEEE C2-	**(1997) National Electrical Safety Code&**
\&\-IEEE C37.1-	**(1994) IEEE Standard Definition, Specification, and Analysis of Systems Used for Supervisory Control, Data Acquisition, and Automatic Control&**
\&\-IEEE C37.2-	**(1991) Electrical Power System Device Function Numbers&**
\&\-IEEE C37.13-	**(1990) Low-Voltage AC Power Circuit Breakers Used in Enclosures&**
\-IEEE C37.20.1-	**(1993) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear**
\-IEEE C37.20.2-	**(1993; C37.20.2b) Metal-Clad and Station-Type Cubicle Switchgear**
\-IEEE C37.20.3-	**(1987) Metal-Enclosed Interrupter Switchgear**
\-IEEE C37.23-	**(1987; R 1991) Guide for Metal-Enclosed Bus and Calculating Losses in Isolated-Phase Bus**
\-IEEE C37.30-	**(1992) Definitions and Requirements for High-Voltage Air Switches, Insulators, and Bus Supports**
\-IEEE C37.34-	**(1994) Test Code for High-Voltage Air Switches**
\-IEEE C37.41-	**(1994) Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories**
\-IEEE C37.63-	**(1984; R 1990) Requirements for Overhead, Pad-Mounted, Dry-Vault, and Submersible Automatic Line Sectionalizer for AC Systems**
\&\-IEEE C37.90-	**(1989) Relays and Relay Systems Associated with Electric Power Apparatus&**
\-IEEE C37.90.1-	**(1989; R 1991) IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems**
\-IEEE C37.98-	**(1987; R 1991) Seismic Testing of Relays**
\-IEEE C57.12.00-	**(1993) IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers**
\-IEEE C57.13-	**(1993) Instrument Transformers**
\-IEEE C57.98-	**(1993) Guide for Transformer Impulse Tests**
\-IEEE C62.1-	**(1989; R 1994) Surge Arresters for ac Power Circuits**
\-IEEE C62.2-	**(1987; R 1994) Guide for the Application of Gapped Silicon-Carbide Surge Arresters for Alternating Current Systems**
\-IEEE C62.11-	**(1993) IEEE Standard Metal-Oxide Surge Arresters for AC Power Circuits**

\-IEEE Std 48-	**\&(1996) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV&**
\-IEEE Std 81-	**(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)**
\-IEEE Std 100-	**(1992) IEEE Standard Dictionary of Electrical and Electronics Terms**
\&\-IEEE Std 242-	**(1986; R 1991) Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems&**
\-IEEE Std 386-	**(1995) Separable Insulated Connector Systems for Power Distribution Systems Above 600V**
\&\-IEEE Std 399-	**(1990) Recommended Practice for Industrial and Commercial Power System Analysis&**
\-IEEE Std 404-	**(1993) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V through 46 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V**
\-IEEE Std 590-	**(1977; R 1991) IEEE Cable Plowing Guide**
\-IEEE Std 592-	**(1990) Exposed Semiconducting Shields on Premolded High Voltage Cable Joints and Separable Insulated Connectors**

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

\-NEMA AB 1-	**(1993) Molded Case Circuit Breakers and Molded Case Switches**
\-NEMA BU 1-	**(1994) Busways**
\-NEMA FB 1-	**(1993) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit and Cable Assemblies**
\-NEMA FU 1-	**(1986) Low Voltage Cartridge Fuses**
\-NEMA LA 1-	**(1992) Surge Arresters**
\-NEMA PB 1-	**(1990) Panelboards**
\-NEMA PB 2-	**(1989) Deadfront Distribution Switchboards**
\-NEMA SG 2-	**(1993) High Voltage Fuses**
\-NEMA SG 3-	**(1990) Low-Voltage Power Circuit Breakers**
\-NEMA SG 5-	**(1990) Power Switchgear Assemblies**
\-NEMA TC 5-	**(1990) Corrugated Polyolefin Coilable Plastic Utilities Duct**
\-NEMA TC 6-	**(1990) PVC and ABS Plastic Utilities Duct for Underground Installation**

\-NEMA TC 7-	**(1990) Smooth-Wall Coilable Polyethylene Electrical Plastic Duct**
\-NEMA WC 7-	**(1993) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy**
\-NEMA WC 8-	**(1993) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy**

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

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

UNDERWRITERS LABORATORIES (UL)

\-UL 6-	**\&(1993; Rev March 96)&\ Rigid Metal Conduit**
\&\-UL 198C-	**(1986; Rev thru Jun 1993) High-Interrupting-Capacity Fuses, Current-Limiting Types&**
\&\-UL 198D-	**(1995) Class K Fuses&**
\-UL 198E-	**(1988; Rev Jul 1988) Class R Fuses**
\&\-UL 198H-	**(1988; Rev thru Nov 1993) Class T Fuses&**
\-UL 467-	**\&(1993; Rev thru Aug 1996)&\ Grounding and Bonding Equipment**
\-UL 486A-	**(1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors**
\-UL 486B-	**\&(1991; Rev thru Oct 1996)&\ Wire Connectors for Use with Aluminum Conductors**
\-UL 489-	**\&(1996)&\ Molded-Case Circuit Breakers and Circuit-Breaker Enclosures**
\-UL 510-	**(1994) Insulating Tape**
\-UL 514A-	**\&(1996)&\ Metallic Outlet Boxes**
\-UL 651-	**\&(1995)&\ Schedule 40 and 80 Rigid PVC Conduit**
\-UL 854-	**\&(1996; Rev May 1996)&\ Service-Entrance Cables**
\-UL 857-	**\&(1994; Rev Oct 1994)&\ Busways and Associated Fittings**
\-UL 1242-	**\&(1996)&\ Intermediate Metal Conduit**
\-UL 1684-	**(1993) Reinforced Thermosetting Resin Conduit**

1.2 GENERAL REQUIREMENTS

1.2.1 Terminology

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

[AM#1]
1.3 SUBMITTALS

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

SD-01 Data\

___

Manufacturer's Catalog Data\; *FIO*\.

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

Material, Equipment, and Fixture Lists\; *FIO*\.

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

Installation Procedures\; *FIO*\.

As a minimum, installation procedures for transformers, substations, switchgear, and medium-voltage cable terminations and splices.

Procedures shall include cable pulling plans, diagrams, instructions, and precautions required to install, adjust, calibrate, and test the devices and equipment.

SD-04 Drawings\

Electrical Distribution System\; *FIO*\.

Detail drawings consisting of equipment drawings, illustrations, schedules, instructions, diagrams manufacturers standard installation drawings and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings.

If departures from the contract drawings are deemed necessary by the Contractor, complete details of such departures shall be included with the detail drawings. Approved departures shall be made at no additional cost to the Government.

Detail drawings shall show how components are assembled, function together and how they will be installed on the project. Data and drawings for component parts of an item or system shall be coordinated and submitted as a unit. Data and drawings shall be coordinated and included in a single submission. Multiple submissions for the same equipment or system are not acceptable except where prior approval has been obtained from the Contracting Officer. In such cases, a list of data to be submitted later shall be included with the first submission. Detail drawings shall consist of the following:

a. Detail drawings showing physical arrangement, construction details, connections, finishes, materials used in fabrication, provisions for conduit or busway entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and equipment weight. Drawings shall be drawn to scale and/or dimensioned. All optional items shall be clearly identified as included or excluded.

b. Internal wiring diagrams of equipment showing wiring as actually provided for this project. External wiring connections shall be clearly identified.

Detail drawings shall as a minimum depict the installation of the following items:

a. Medium-voltage cables and accessories including cable installation plan.

b. Transformers.

c. Substations.

d. Switchgear.

e. Pad-mounted loadbreak switches.

f. Busways.

g. Surge arresters.

As-Built Drawings\; *FIO*\.

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, size, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall provide 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 10 calendar days from the time the drawings are returned to the Contractor.

SD-09 Reports\

Factory Test\; *FIO*\.

Certified factory test reports shall be submitted when the manufacturer performs routine factory tests, including tests required by standards listed in paragraph REFERENCES. Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days following successful completion of the tests. The manufacturer's pass-fail criteria for tests specified in paragraph FIELD TESTING shall be included.

Field Testing\; *GA*\.

A proposed field test plan, 20 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Test Reports\; *GA*\.

Six copies of the information described below in\~ 8-1/2 by 11 inch~\ binders having a minimum of three rings, including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.

b. A copy of measurements taken.

c. The dates of testing.

d. The equipment and values to be verified.

e. The condition specified for the test.

f. The test results, signed and dated.

g. A description of adjustments made.

Cable Installation Reports\; *GA*\.

Six copies of the information described below in\~ 8-1/2 by 11 inch~\ binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

a. Site layout drawing with cable pulls numerically identified.

b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.

c. The cable manufacturer and type of cable.

d. The dates of cable pulls, time of day, and ambient temperature.

e. The length of cable pull and calculated cable pulling tensions.

f. The actual cable pulling tensions encountered during pull.

SD-13 Certificates\

Materials and Equipment\; *FIO*\.

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies. Compliance with above-named requirements does not relieve the Contractor from compliance with any other requirements of the specifications.

Cable Splicer Qualification\; *FIO*\.

A certification that contains the names and the qualifications of people recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract. The certification shall indicate that any person recommended to perform actual splicing and terminations has been adequately trained in the proper techniques and have had at least three recent years of experience in splicing and terminating the same or similar types of cables approved for installation. In addition, any person recommended by the Contractor may be required to perform a practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage cables. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

Cable Installer Qualifications\; *FIO*\.

The Contractor shall provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. A resume shall be provided showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers.

SD-19 OPERATION AND MAINTENANCE MANUALS\

Electrical Distribution System\; *GA*\.

Six copies of operation and maintenance manuals, within 7 calendar days following the completion of tests and including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data outlining detailed procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment, basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

Three additional copies of the instructions manual shall be provided within 30 calendar days following the manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Oil filled transformers and switches shall be stored in accordance with the manufacturer's requirements. Wood poles held in storage for more than 2 weeks shall be stored in accordance with \-ANSI O5.1-\. Handling of wood poles shall be in accordance with \-ANSI O5.1-\, except that pointed tools capable of producing indentations more than\~ 1 inch~\ in depth shall not be used. Metal poles shall be handled and stored in accordance with the manufacturer's instructions.

1.5 EXTRA MATERIALS

One additional spare fuse or fuse element for each furnished fuse or fuse element shall be delivered to the contracting officer when the electrical system is accepted. Two complete sets of all special tools required for maintenance shall be provided, complete with a suitable tool box. Special tools are those that only the manufacturer provides, for special purposes (to access compartments, or operate, adjust, or maintain special parts).

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 NAMEPLATES

2.2.1 General

Each major component of this specification shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal. Equipment containing liquid dielectrics shall have the type of dielectric on the nameplate. Sectionalizer switch nameplates shall have a schematic with all switch positions shown and labeled. As a minimum, nameplates shall be provided for transformers, circuit breakers, meters, switches, and switchgear.

2.2.2 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with nameplate information in accordance with \-IEEE C57.12.00-\. Nameplates shall indicate the number of\~ gallons~\ and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is non-polychlorinated biphenyl. If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric is non-PCB classified, with less than 50 ppm PCB content in accordance with paragraph LIQUID DIELECTRICS. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 50 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

2.3 CORROSION PROTECTION

2.3.1 Aluminum Materials

Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to \-UL 486B-\ shall be used.

2.3.2 Ferrous Metal Materials

2.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with \-ASTM A 153-\ and \-ASTM A 123-\.

2.3.2.2 Equipment

Equipment and component items, including but not limited to transformer stations and ferrous metal luminaries not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in \-ASTM B 117-\ without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of\~ 1/16 inch~\ from the test mark. The scribed test mark and test evaluation shall be in accordance with \-ASTM D 1654-\ with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory shall be as specified in Section \=09900=\ PAINTING, GENERAL.

2.4 CABLES

Cables shall be single conductor type unless otherwise indicated.

2.4.1 Conductor Material

Underground cables shall be of soft drawn copper conductor material.

2.4.2 Medium-Voltage Cables

2.4.2.1 General

Medium voltage cables shall conform to the requirements of \-NEMA WC 7-\ for cables utilizing cross-linked thermosetting polyethylene ((XLP) insulation and \-NEMA WC 8-\ for cables utilizing ethylene-propylene-rubber (EPR) insulation. Cables shall be in accordance with the requirements of \-NFPA 70-\. If metallic armored cables are specified, then they shall be three-conductor, multiple-conductor cable with interlocked-metal tape armor and thermoplastic jackets as required for underground installations.

2.4.2.2 Insulation

Cables shall utilize cross-linked thermosetting polyethylene (XLP) insulation orethylene-propylene-rubber (EPR) insulation. Cables shall be provided with 133 percent insulation level.

2.4.2.3 Jackets

Cables shall be provided with a nonmetallic jacket. Concentric neutral cables for direct buried applications shall have a moisture-resistant, nonmetallic jacket rated for direct burial.

2.4.2.4 Neutrals

Neutral conductors of grounded neutral systems except for concentric neutral cables shall be of the same insulation material as phase conductors, except that a 600-volt insulation rating is acceptable. Cables employing a concentric neutral shall have 1/3 concentric neutral with an insulating jacket over the concentric neutral.

2.4.2.5 Shielding

Cables rated for above 2 kV shall have both conductor and insulation shielding for each phase, except insulation shielding is not required for 5 kV armored or metallic-sheathed cable.

2.4.2.6 Ratings

Medium-voltage cables shall be rated for a circuit voltage 15 kV .

2.4.3 Low-Voltage Cables

Cables shall be rated 600 volts and shall conform to the requirements of \-NFPA 70-\. Cables shall utilize ethylene-propylene-rubber (EPR) insulation and shall conform to the requirements of \-NEMA WC 8-.

2.4.3.1 In Duct

Cables shall be single-conductor cable, Type RHW, THW, THWN, TW, USE, or XHHW in accordance with \-NFPA 70-\. Cables in factory-installed, coilable-plastic-duct assemblies shall conform to \-NEMA TC 5-\ or \-NEMA TC 7-\.

2.5 CABLE JOINTS, TERMINATIONS, AND CONNECTORS

2.5.1 Medium-Voltage Cable Joints

Medium-voltage cable joints shall comply with \-IEEE Std 404-\ and \-IEEE Std 592-\. Medium-voltage cable terminations shall comply with \-IEEE Std 48-\. Joints shall be the standard products of a manufacturer and shall be either of the factory preformed type or of the kit type containing tapes and other required parts. Joints shall have

ratings not less than the ratings of the cables on which they are installed. Splice kits may be of the heat-shrinkable type for voltages up to 15 kV, of the premolded splice and connector type, the conventional taped type, or the resin pressure-filled overcast taped type for voltages up to 35 kV; except that for voltages of 7.5 kV or less a resin pressure-filled type utilizing a plastic-tape mold is acceptable. Joints used in manholes, handholes, vaults and pull boxes shall be certified by the manufacturer for waterproof, submersible applications.

[AM#1]
2.5.2 Medium-Voltage Separable Insulated Connectors

Separable insulated connectors shall comply with \-IEEE Std 386-\ and \-IEEE Std 592-\ and shall be of suitable construction or standard splice kits shall be used. Separable insulated connectors are acceptable for voltages up to 35 kV. Connectors shall be of the loadbreak type as indicated, of suitable construction for the application and the type of cable connected, and shall include cable shield adaptors. Separable insulated connectors shall not be used in manholes. External clamping points and test points shall be provided.

2.5.3 Low-Voltage Cable Splices

Low-voltage cable splices and terminations shall be rated at not less than 600 Volts. Splices in conductors No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of \-UL 486A-\. Splices in conductors No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, conforming to the applicable requirements of \-UL 486A-\ and \-UL 486B-\. Splices shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket. Splices below grade or in wet locations shall be sealed type conforming to \-ANSI C119.1-\ or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

[AM#1]
2.5.4 Terminations

Terminations shall be in accordance with \-IEEE Std 48-\, Class 1 or Class 2; of the wet-process porcelain type. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

[AM#1]
2.6 CONDUIT AND DUCTS

Duct lines shall be concrete-encased, thin-wall type.

2.6.1 Metallic Conduit

Intermediate metal conduit shall comply with \-UL 1242-\. Rigid galvanized steel conduit shall comply with \-UL 6-\ and \-ANSI C80.1-\. Metallic conduit fittings and outlets shall comply with \-UL 514A-\ and \-NEMA FB 1-\.

2.6.2 Nonmetallic Ducts

2.6.2.1 Concrete Encased Ducts

\-UL 651-\ Schedule 40 or \-NEMA TC 6-\ Type EB.

2.6.2.2 Direct Burial

\-UL 651-\ Schedule 40andSchedule 80as indicated, or \-NEMA TC 6-\ Type DB.

2.6.3 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as\~ 35 degrees F,~\ shall neither slump at a temperature of\~ 300 degrees F,~\ nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

2.7 MANHOLES, HANDHOLES, AND PULLBOXES

Manholes, handholes, and pullboxes shall be as indicated. Strength of manholes, handholes, and pullboxes and their frames and covers shall conform to the requirements of \&\-IEEE C2-\&\. Precast-concrete manholes shall have the required strength established by \-ASTM C 478-\. Frames and covers shall be made of gray cast iron and a machine-finished seat shall be provided to ensure a matching joint between frame and cover. Cast iron shall comply with \-ASTM A 48-\, Class 30B, minimum. Handholes for low voltage cables installed in parking lots, sidewalks, and turfed areas shall be fabricated from an aggregate consisting of sand and with continuous woven glass strands having an overall compressive strength of at least\~ 10,000 psi~\ and a flexural strength of at least\~5,000 psi.~\ Pullbox and handhole covers in sidewalks, and turfed areas shall be of the same material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

2.8 POLES AND HARDWARE

Poles and hardware shall be in accordance with Section \=16370=\ ELECTRICAL DISTRIBUTION SYSTEM, AERIAL.

2.9 TRANSFORMERS, SUBSTATIONS, AND SWITCHGEAR

Transformers, substations, and switchgear shall be of the outdoor type having the ratings and arrangements indicated. Medium-voltage ratings of cable terminations shall be15 kV between phases for 133 percent insulation level.

2.9.1 Secondary Unit Substation

Secondary unit substations shall comply with \-ANSI C37.121-\ and shall be of the radial type. Substations shall be subassembled and coordinated by one manufacturer and shall be shipped in complete sections ready for connection at the site. Complete sections shall include incoming, transformer, and outgoing sections and, where practicable, shall be shipped as one unit.

2.9.1.1 Incoming Section

Metal-enclosed interrupter switchgear consisting of fused, air-insulated, interrupters in series with automatic, visible blade disconnects shall be provided for protection of incoming circuits. Metal-enclosed interrupter switchgear shall comply with \-IEEE C37.30-\ for load-interrupter switches, \-NEMA SG 2-\ for power fuses, and shall be of the outdoor no-aisle type that meets or exceeds the requirements of applicable publications listed&\. Switch construction shall be of the manually-operated, "OPEN-CLOSED," \&air-insulated&\, load interrupter type equipped with a stored energy operator for quick-make quick-break to make operating speeds independent of manual switch operations. Where indicated, suitable bus or lug connections shall be provided to mount field-installed, slip-on, medium-voltage cable terminations for cable entering via conduit from below and a flanged throat suitable for direct connection to the associated transformer. Surge protection shall be provided in accordance with paragraph SURGE ARRESTERS. Switches shall be of the 2-position type, open-closed.

a. Ratings. Fuse continuous current ratings shall be as indicated for the transformer for an incoming line unit and for the line tie unit. Unless otherwise indicated, fuses shall be of the current limiting type. Switch ratings at 60 Hz shall be:

Nominal voltage.....15KV.

Rated maximum voltage.....15.5KV.

BIL.....110KV.

b. Basic Requirements. The electrical devices listed below shall be rated for the application and voltage and current indicated. Unless otherwise noted, manufacturer's standard devices shall be provided and shall include the following:

(1) A switch-operating handle with provisions for locking in either the open or closed position.

(2) A switch mechanical position indicator.

(3) A heater continuously energized to prevent condensation over an ambient temperature range of \&\~ minus 20 degrees F to 40 degrees F]~\ at 90% relative humidity&\ and wired in series with a cabinet door-actuated switch, so the heater is de-energized when doors are open. High-temperature thermal protection shall be included.

(4) One-pole or 2-pole thermal-magnetic, molded-case circuit breakers suitable for the operating voltage for heater circuits.

(5) Safety devices as necessary to ensure that the load interrupter switch is in the open position whenever unit doors are in the open position.

(6) A key interlock if indicated.

(7) An interface terminal block wired for required exterior connections.

2.9.1.2 Transformer Section

Transformers shall have two separate windings per phase and shall be of the mineral oil-insulated. Transformers shall be suitable for outdoor use. Liquid-insulated transformers shall comply with \-IEEE C57.12.00-\, \-ANSI C57.12.13-\, and \-ANSI C57.12.27-\, and shall have two 2-1/2 percent full capacity taps above and two 2-1/2 percent full capacity taps below rated voltage. Transformers shall be of the sealed tank type construction with welded-on cover. High-voltage terminals shall be provided in an air terminal chamber for incoming bottom entry cables. Low-voltage terminals shall be provided for direct connection to the outgoing switchgear section. Transformer accessories and ratings at 60 Hz shall be as follows:

Three-phase capacity, self-cooled.....As shown on drawings._____

Three-phase capacity, (future) forced-cooled.....As shown on drawings.

Impedance..5.75 percent, standard.

Temperature rise.....65 degrees C.

Accessories:

a. drain and filter connection.

b. filling and top filter press connection.

c. pressure-vacuum gauge.

d. dial type thermometer with alarm contacts.

e. magnetic liquid level indicator with high and low level alarm contacts.

f. pressure relief device with alarm contacts.

g. ground connection pad.

h. provision for jacking, lifting, and towing.

i. diagram and rating nameplate.

2.10 \&METERING AND PROTECTIVE DEVICES&

2.10.1 \&Circuit Breakers, Low-Voltage&

2.10.1.1 Molded-Case Circuit Breakers

\-NEMA AB 1-\ and \-UL 489-\.

2.10.2 \&Instrument Transformers&

2.10.2.1 \&General&

Instrument transformers shall comply with \-ANSI C12.11-\ and \-IEEE C57.13-\. Instrument transformers shall be configured for mounting in/on the device to which they are applied. Polarity marks on instrument transformers shall be visually evident and shown on drawings.

2.10.2.2 \&Current Transformers&

Unless otherwise indicated, bar, wound, or window-type transformers are acceptable; and except for window-type units installed over insulated buses, transformers shall have a BIL rating consistent with the rated BIL of the associated switchgear or electric power apparatus bushings, buses or conductors. Current transformers shall have the indicated ratios. The continuous thermal-current rating factor shall not be less than 1.0. Other thermal and mechanical ratings of current transformers and their primary leads shall be coordinated with the design of the circuit breaker and shall be not less than the momentary rating of the associated circuit breaker. Circuit protectors shall be provided across secondary leads of the current transformers to prevent the accident open-circuiting of the transformers while energized. Each terminal of each current transformer shall be connected to a short-circuiting terminal block in the circuit interrupting mechanism cabinet, power transformer terminal cabinet, and in the associated instrument and relay cabinets.

2.10.2.3 Current Transformers for Kwh and Demand Metering (Low-Voltage)

Current transformers shall conform to \-IEEE C57.13-\. Provide current transformers with a metering accuracy Class of 0.3 through B-0.9, with a minimum RF of 1.5 at 30 degrees C, with 600-volt insulations, and 10 kV BIL. Provide butyl-molded, window-type current transformers mounted on the transformer low-voltage bushings. Route current transformer leads in a location as remote as possible from the power transformer secondary cables to permit current measurements to be taken with hook-on-ammeters.

2.10.2.4 \&Voltage Transformers&

Voltage transformers shall have indicated ratios. Voltage transformers shall be of the drawout type having current-limiting fuses in both primary and secondary circuits. Mechanical interlocks shall prevent removal of fuses, unless the associated voltage transformer is in a drawout position. Voltage transformer compartments shall have hinged doors.

2.10.3 Watthour Meters

Watthour meters shall comply with \-ANSI C12.1-\ and \-ANSI C12.10-\, except that numbered terminal wiring sequence and case size may be the manufacturer's standard. Watthour meters shall be of the drawout switchboard type having a 15 minute, cumulative form, demand register meeting \-ANSI C12.4-\ and provided with not less than 2-1/2 stators. Watthour demand meters shall have factory-installed electronic pulse initiators meeting the requirements of \-ANSI C12.1-\. Pulse initiators shall be solid-state devices incorporating light-emitting diodes, phototransistors, and power transistors, except that mercury-wetted output contacts are acceptable. Initiators shall be totally contained within watthour demand meter enclosures. They shall be capable of operating at speeds up to 500 pulses per minute with no false pulses, and they shall be factory calibrated with no field adjustments being required. Initiators shall be calibrated for a pulse rate output of 1 pulse per 1/4 disc revolution of the associated meter and shall be compatible with the indicated equipment.

2.11 GROUNDING AND BONDING

2.11.1 Driven Ground Rods

Ground rods shall be copper-clad steel conforming to \-UL 467-\ not less than \~ 3/4 inch~\ in diameter by \~ 10 feet~\ in length. Sectional type rods may be used.

2.11.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be \-ASTM B 8-\ soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.12 CONCRETE AND REINFORCEMENT

Concrete work shall have minimum\~ 3000 psi~\ compressive strength and conform to the requirements of Section \=03300=\ CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete reinforcing shall be as specified in Section \=03200=\ CONCRETE REINFORCEMENT.

2.13 PADLOCKS

Padlocks shall conform to \-ASTM F 883-\, Type EPC, size 2.

2.14 CABLE FIREPROOFING SYSTEMS

Cable fireproofing systems shall be listed in \-FM P7825-\ as a fire-protective coating or tape approved for grouped electrical conductors and shall be suitable for application on the type of medium-voltage cables provided. After being fully cured, materials shall be suitable for use where exposed to oil, water, gases, salt water, sewage, and fungus and shall not damage cable jackets or insulation. Asbestos materials are not acceptable.

2.14.1 Fireproof Coating

Cable fireproofing coatings shall be compounded of water-based thermoplastic resins, flame-retardant chemicals, and inorganic noncombustible fibers and shall be suitable for the application methods used. Coatings applied on bundled cables shall have a derating factor of less than 5 percent, and a dielectric strength of 95 volts per mil minimum after curing.

2.14.2 Fireproofing Tape

Fireproofing tape shall be at least\~ 2 inches~\ wide and shall be a flexible, conformable, polymeric, elastomer tape designed specifically for fireproofing cables.

2.14.3 Plastic Tape

Preapplication plastic tape shall be pressure sensitive,\~ 10 mil~\ thick, conforming to \-UL 510-\.

2.15 LIQUID DIELECTRICS

Liquid dielectrics for transformers, capacitors, reclosers, and other liquid-filled electrical equipment shall be non-polychlorinated biphenyl (PCB) mineral-oil or less-flammable liquid as specified. Nonflammable fluids shall not be used. Tetrachloroethylene (perchloroethylene) and 1, 2, 4 trichlorobenzene fluids shall not be used. Liquid dielectrics in retrofitted equipment shall be certified by the manufacturer as having less than \&50&\ parts per million (ppm) PCB content. In lieu of the manufacturer's certification, the Contractor may submit a test sample of the dielectric in accordance with \-ASTM D 923-\ and have tests performed per \-ASTM D 4059-\ at a testing facility approved by the Contracting Officer. Equipment with test results indicating PCB level exceeding \&50&\ ppm shall be replaced.

2.16 FACTORY TESTS

Factory tests shall be performed, as follows, in accordance with the applicable publications and with other requirements of these specifications. The Contracting Officer shall be notified at least 10 days before the equipment is ready for testing. The Contracting Officer reserves the right to witness the tests.

a. Transformers: Manufacturer's standard routine tests in accordance with \-IEEE C57.12.00-\.

b. Transformers rated 200 kVA and above: Reduced full-wave, chopped-wave, and full-wave impulse test on each line and neutral terminal, in accordance with \-IEEE C57.98-\.

c. Instrument Current Transformers: Manufacturer's standard tests in accordance with \-IEEE C57.13-\.

d. Factory Preformed Terminations: Wet withstand voltage tests in accordance with \-IEEE Std 48-\ for the next higher BIL level.

e. Outdoor Switchgear: Manufacturer's standard tests in accordance with \-IEEE C37.20.1-\, \-IEEE C37.20.2-\, and \-IEEE C37.20.3-\.

f. Electrical Power Insulators: Manufacturer's standard tests in accordance with \-ANSI C29.1-\.

2.17 FENCING

Fencing shall conform to the requirements of Section \=02831=\ CHAIN LINK FENCE.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions. Circuits installed aerially shall conform to the requirements of Section \=16370=\ ELECTRICAL DISTRIBUTION SYSTEM, AERIAL. Steel conduits installed underground shall be installed and protected from corrosion in conformance with the requirements of Section \=16415=\ ELECTRICAL WORK, INTERIOR. Except as covered herein, excavation, trenching, and backfilling shall conform to the requirements of Section \=02222=\ EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. \&Concrete work shall have minimum\~ 3000 psi~\compressive strength and conform to the requirements of Section \=03300=\CAST-IN-PLACE STRUCTURAL CONCRETE&\.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of \-NFPA 70-\ and \&\-IEEE C2-\&\ as applicable.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing any work.

3.1.3 Disposal of Liquid Dielectrics

PCB-contaminated dielectrics must be marked as PCB and transported to and incinerated by an approved EPA waste disposal facility. The Contractor shall furnish certification of proper disposal. Contaminated dielectrics shall not be diluted to lower the contamination level.

3.2 CABLE AND BUSWAY INSTALLATION

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, etc. The Contractor shall then prepare a checklist of significant requirements and perform pulling calculations and prepare a pulling plan] which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS.

3.2.1 Cable Installation Plan and Procedure

Cable shall be installed strictly in accordance with the cable manufacturer's recommendations. Each circuit shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

3.2.1.1 Cable Inspection

The cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable in accordance with the cable manufacturer's recommendations.

3.2.1.2 Duct Cleaning

Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is\~ 1/4 inch~\ less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of 2 times or until less than a volume of\~ 8 cubic inches~\ of debris is expelled from the duct.

3.2.1.3 Duct Lubrication

The cable lubricant shall be compatible with the cable jacket for cable that is being installed. Application of lubricant shall be in accordance with lubricant manufacturer's recommendations.

3.2.1.4 Cable Installation

The Contractor shall provide a cable feeding truck and a cable pulling winch as required. The Contractor shall provide a pulling grip or pulling eye in accordance with cable manufacturer's recommendations. The pulling grip or pulling eye apparatus shall be attached to polypropylene or manilla rope followed by lubricant front end packs and then by power cables. A dynamometer shall be used to monitor pulling tension. Pulling tension shall not exceed cable manufacturer's recommendations. The Contractor shall not allow cables to cross over while cables are being fed into duct. For cable installation

in cold weather, cables shall be kept at\~ 50 degrees F~\ temperature for at least 24 hours before installation.

3.2.1.5 Cable Installation Plan

The Contractor shall submit a cable installation plan for all cable pulls in accordance with the detail drawings portion of paragraph SUBMITTALS. Cable installation plan shall include:

a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

b. List of cable installation equipment.

c. Lubricant manufacturer's application instructions.

d. Procedure for resealing cable ends to prevent moisture from entering cable.

e. Cable pulling tension calculations of all cable pulls.

f. Cable percentage conduit fill.

g. Cable sidewall thrust pressure.

h. Cable minimum bend radius and minimum diameter of pulling wheels used.

i. Cable jam ratio.

j. Maximum allowable pulling tension on each different type and size of conductor.

k. Maximum allowable pulling tension on pulling device.

3.2.2 Duct Line

Cables shall be installed in duct lines where indicated. Cable splices in low-voltage cables shall be made in manholes and handholes only, except as otherwise noted. Cable joints in medium-voltage cables shall be made in manholes or approved pullboxes only. Neutral and grounding conductors shall be installed in the same duct with their associated phase conductors.

3.2.3 Electric Manholes

Cables shall be routed around the interior walls and securely supported from walls on cables racks. Cable routing shall minimize cable crossover, provide access space for maintenance and installation of additional cables, and maintain cable separation in accordance with \-IEEE C2-\.

3.2.4 Busway Installation

Busways penetrating walls shall have wall flanges installed on both surfaces of walls. Wall openings shall be approximately\~ 1/4 inch~\ larger than the busway on each of the 4 busway sides, and openings shall be sealed with a suitable compound. Fire barriers shall be provided when penetrating fire rated walls. Fire barriers shall have a rating equal to the fire wall rating. A weather barrier shall be used when a busway penetrates an exterior wall. Busways shall be supported at intervals not exceeding\~ 10 feet~\ and shall be braced to prevent lateral movement.

3.3 CABLE JOINTS

Medium-voltage cable joints shall be made by qualified cable splicers only. Qualifications of cable splicers shall be submitted in accordance with paragraph SUBMITTALS. Shields shall be applied as required to continue the shielding system through each entire cable joint. Shields may be integrally molded parts of preformed

joints. Shields shall be grounded at each joint or in accordance with manufacturer's recommended practice. Cable joints shall provide insulation and jacket equivalent to

compound-filled, cast-iron or alloy, splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

FIREPROOFING

Each medium-voltage cable and conductor in manholes shall be fire-proofed for their

enhance pulling into ducts, the lubricant shall be removed from cables and conductors exposed in the manhole before fireproofing.

Tape Method

Before application of fireproofing tape, plastic tape wrapping shall be applied over

to minimize the possibility of corrosion from the fireproofing materials and moisture. Before applying fireproofing tape, irregularities of cables, such as at cable joints,

fireproof tape shall be wrapped tightly around each cable spirally in 1/2 lapped wrapping or in 2 butt-jointed wrappings with the second wrapping covering the joints of

3.4.2 Sprayable Method

are cured. Ventilation requirements shall be in accordance with the manufacturer's instruction, but not less than 10 air changes per hour shall be provided. Cable

to the dry film thickness approved for fireproofing by \-FM P7825-\. Application methods and necessary safety precautions shall be in accordance with the manufacturers

hours and fully cured in 48 hours, except where the manufacturer has stated that because of unusual humidity or temperature, longer periods may be necessary.

DUCT LINES

3.5.1

Numbers and sizes of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of\~ 4 inches per 100 feet.~\ Depending on the contour of the finished

or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum

diameter, and\~ 36 inches~\ for ducts\~ 3 inches~\ or greater in diameter. Otherwise, long sweep bends having a minimum radius of\~ 25 feet~\ shall be used for a change of

straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end

3.5.2 Treatment

Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is

warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic

3.5.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with \-NFPA 70-\, except that electrical duct bank configurations for ducts\~ 6 inches~\ in diameter shall be determined by calculation and as shown on the drawings. The separation between adjacent electric power and communication ducts shall conform to \&\-IEEE C2-\&\. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. The Contractor shall submit proposed bonding method for approval in accordance with the detail drawing portion of paragraph SUBMITTALS. At any point, except railroad and airfield crossings, tops of concrete encasements shall be not less than three feet below grade except as shown on the contract drawings and the cover requirements listed in \-NFPA 70-\ with mil, 6 inch wide PE marking tape (no foil) placed above at one foot below grade. At railroad and airfield crossings, duct lines shall be encased with concrete and reinforced as indicated to withstand specified surface loadings. Tops of concrete encasements shall be not less than\~ 5 feet~\ below tops of rails or airfield paving unless otherwise indicated. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than\~ 50 feet~\ in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than\~ 4 feet~\ on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete and joints shall be staggered at least\~ 6 inches~\ vertically.

3.5.4 Nonencased Direct-Burial

Top of duct lines shall be below the frost line depth not less than\~ 24 inches~\ below finished grade and shall be installed with a minimum of\~ 3 inches~\ of earth around each duct, except that between adjacent electric power and communication ducts,\~ 12 inches~\ of earth is required. Bottoms of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a\~ 3 inch~\ layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least\~ 6 inches.~\ The first\~ 6 inch~\ layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in\~ 3 to 6 inch~\ layers. Duct banks may be held in alignment with earth. However, high-tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

3.5.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved.

3.5.5.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

3.5.6 Duct Line Markers

Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of duct curvature or terminations at completely below-grade structures. In addition to markers, a\~ 5 mil~\brightly colored plastic tape, not less than\~ 3 inches~\ in width and suitably inscribed at not more than\~ 10 feet~\ on centers with a continuous metallic backing and a corrosion-resistant\~ 1 mil~\ metallic foil core to permit easy location of the duct line, shall be placed approximately\~ 12 inches~\ below finished grade levels of such lines.

3.6

3.6.1 General

manhole shall be determined after careful consideration has been given to the location of other utilities, grading, and paving. The location of each manhole shall be approved

shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Top, walls, and bottom shall consist of reinforced

Contractor may at his option utilize monolithically constructed precast-concrete manholes having the required strength and inside dimensions as required by the drawings

in vehicular traffic areas shall be flush with the finished surface of the paving. In unpaved areas, the top of manhole covers shall be approximately\~ 1/2 inch~\ above the

encountered, concrete assemblies designed for the purpose shall be installed to elevate temporarily the manhole cover to existing grade level. \&All duct lines entering

manhole to prevent shear stress on the duct at the point of entrance to the manhole. Duct lines entering cast-in-place concrete manholes shall be cast in-place with the

penetration shall be grouted tight with a portland cement mortar. PVC duct lines entering precast manholes through a PVC endbell shall be solvent welded to the

manhole sump. A cable-pulling iron shall be installed in the wall opposite each duct line entrance.

Electric Manholes

Cables shall be securely supported from walls by hot-dip galvanized cable racks with a

The number of cable racks indicated shall be installed in each manhole and not less than 2 spare hooks shall be installed on each cable rack. Insulators shall be made of

3.6.3 Communications Manholes

indicated shall be installed in each telephone manhole. Each cable rack shall be provided with 2 cable hooks. Cables for the telephone and communication systems will be

3.6.4 Handholes

on the drawings and shall be constructed in accordance with the details shown.

3.6.5

Pullbox tops shall be flush with sidewalks or curbs or placed\~ 1/2 inch~\ above surrounding grades when remote from curbed roadways or sidewalks. Covers shall be

shall have a suitable opening for a ground rod. Conduit, cable, ground rod entrances, and unused openings shall be sealed with mortar.

Ground Rods

A ground rod shall be installed at the manholes, handholes and pullboxes. Ground rods

\~4 inches~\ of the ground rod will extend above the manhole floor. When precast concrete manholes are used, the top of the ground rod may be below the manhole floor and

a No. 1/0 AWG ground conductor brought into the manhole through a watertight sleeve in the manhole wall.

3.7 PAD-MOUNTED EQUIPMENT INSTALLATION

Pad-mounted equipment, shall be installed on concrete pads in accordance with the manufacturer's published, standard installation drawings and procedures, except that they shall be modified to meet the requirements of this document. Units shall be installed so that they do not damage equipment or scratch painted or coated surfaces. After installation, surfaces shall be inspected and scratches touched up with a paint or coating provided by the manufacturer especially for this purpose.

3.7.1 Concrete Pads

[AM#1]
3.7.1.1 Construction

Concrete pads for pad-mounted electrical equipment shall be poured-in-place. Pads shall be constructed as indicated, except that exact pad dimensions and mounting details are equipment specific and are the responsibility of the Contractor. Tops of concrete pads shall be level and shall project \~4 inches~\above finished paving or grade and sloped to drain. Edges of concrete pads shall have \~3/4 inch~\ chamfer. Conduits for primary, secondary, and grounding conductors shall be set in place prior to placement of concrete pads. Where grounding electrode conductors are installed through concrete pads, PVC conduit sleeves shall be installed through the concrete to provide physical protection. To facilitate cable installation and termination, the concrete pad shall be provided with a rectangular hole below the primary and secondary compartments, sized in accordance with the manufacturer's recommended dimensions. Upon completion of equipment installation the rectangular hole shall be filled with masonry grout.

3.7.1.2 Concrete and Reinforcement

Concrete work shall have minimum\~ 3000 psi~\ compressive strength and comform to the requirements of Section \=03300=\ CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete pad reinforcement shall be in accordance with Section \=03200=\ CONCRETE REINFORCEMENT.

3.7.1.3 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.7.2 Padlocks

Padlocks shall be provided for pad-mounted equipment and for each fence gate. Padlocks shall be keyed alike as directed by the Contracting Officer.

3.7.3 Fencing

Fencing shall conform to the requirement of and be installed in accordance with Section \=02831=\ CHAIN LINK FENCE. Fences shall provide working clearances for operation and maintenance in accordance with \&\-IEEE C2-\&\. The entire space between fences and concrete pads shall be excavated to a minimum depth of \~4 inches~\ below finished gradelines, shall be graded to reasonably level surfaces, and filled with well-compacted clean coarse gravel or crushed stone of \~1/2 to 1-1/2 inches~\ graded size up to finished gradelines. Space between fences and concrete pads shall be excavated to a minimum depth of \~4 inches~\ below finished gradelines, shall be graded to reasonably level surfaces, and filled with well-compacted clean coarse gravel or crushed stone of \~1/2 to 1-1/2 inches~\ graded size up to finished gradelines.

3.8 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in conduit to cable terminations. Conduits shall be

secured to the poles by 2-hole galvanized steel pipe straps spaced not more than \~10 feet~\ apart and with 1 strap not more than \~12 inches~\ from any bend or termination.

Cables shall be supported by devices separate from the conduit or guard, near their point of exit from the conduit or guard.

Pole Installation

Pole installation shall be in accordance with Section \=16370=\ ELECTRICAL DISTRIBUTION

3.9 CONNECTIONS TO BUILDINGS

to the first applicable termination point in each building. Interfacing with building interior conduit systems shall be at conduit stubouts terminating \~5 feet~\ outside of

\=16415=\ ELECTRICAL WORK, INTERIOR. After installation of cables, conduits shall be sealed with caulking compound to prevent entrance of moisture or gases into buildings.

GROUNDING

A ground ring consisting of the indicated configuration of bare copper conductors and

frames of metal-enclosed equipment, and other noncurrent-carrying metal parts, such as cable shields, cable sheaths and armor, and metallic conduit shall be grounded. At

Metallic frames and covers of handholes and pull boxes shall be grounded by use of a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

Grounding Electrodes

Grounding electrodes shall be installed as shown on the drawings and as follows:

driven into the earth until the tops of the rods are approximately \~1 foot~\ below finished grade.

copper conductors installed \~24 inches,~\ plus or minus \~3 inches,~\ below finished top of soil grade. Ground ring conductors shall be sized as .

additional electrodes shall be provided interconnected with grounding to achieve the specified ground resistance. The additional electrodes will be up to three,

rod, \~3/4 inch~\ diameter, up to \~30 feet~\ long, coupled and driven with the first rod. In high ground resistance, UL listed chemically charged ground rods

48 hours after rainfall, the Contracting Officer shall be notified immediately.

3.10.2

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors, in compliance with \-UL 467-\, and those below grade shall be

aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

Grounding and Bonding Conductors

Grounding and bonding conductors include conductors used to bond transformer enclosures

conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.10.4 Surge Arrester Grounding

Surge arresters and neutrals shall be bonded directly to the transformer enclosure and then to the grounding electrode system with a bare copper conductor, sized as shown. Lead lengths shall be kept as short as practicable with no kinks or sharp bends.

3.10.5 Manhole, Handhole, or Concrete Pullbox Grounding

Ground rods installed in manholes, handholes, or concrete pullboxes shall be connected to cable racks, cable-pulling irons, the cable shielding, metallic sheath, and armor at each cable joint or splice by means of a No. 4 AWG braided tinned copper wire. Connections to metallic cable sheaths shall be by means of tinned terminals soldered to ground wires and to cable sheaths. Care shall be taken in soldering not to damage metallic cable sheaths or shields. Ground rods shall be protected with a double wrapping of pressure-sensitive plastic tape for a distance of \~2 inches~\ above and \~6 inches~\ below concrete penetrations. Grounding electrode conductors shall be neatly and firmly attached to manhole or handhole walls and the amount of exposed bare wire shall be held to a minimum.

3.11 FIELD TESTING

3.11.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 3 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field test reports shall be signed and dated by the Contractor.

3.11.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.11.3 \+Ground-Resistance Tests+

The resistance of each grounding electrode and the ground ring shall be measured using the fall-of-potential method defined in \-IEEE Std 81-\. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

a. Single rod electrode - 25 ohms.

b. Ground ring - 25 ohms.

3.11.4 \+Medium-Voltage Cable Test+

the medium-voltage cable system shall be given a high potential test. Direct-current voltage shall be applied on each phase conductor of the system by connecting conductors

the other terminal for each test. Prior to making the test, the cables shall be isolated by opening applicable protective devices and disconnecting equipment. The test

voltage, length of time, and other characteristics of the test for initial installation shall be in accordance with \-NEMA WC 7-\ or \-NEMA WC 8-\ for the particular type of

accordance with either \-AEIC CS5-\ or \-AEIC CS6-\ as applicable, and shall not exceed the recommendations of \-IEEE Std 404-\ for cable joints and \-IEEE Std 48-\ for cable

acceptable for testing. Should any cable fail due to a weakness of conductor insulation or due to defects or injuries incidental to the installation or because of improper

shall make necessary repairs or replace cables as directed. Repaired or replaced cables shall be retested.

\+Low-Voltage Cable Test+

Low-voltage cable, complete with splices, shall be tested for insulation resistance

the equipment, and prior to energization. The test voltage shall be 500 volts dc, applied for one minute between each conductor and ground and between all possible

the same trench, duct, or conduit. The minimum value of insulation shall be:

\~R in megohms = (rated voltage in kV + 1) x 1000/(length of cable in feet~\

be retested until failures have been eliminated.

3.11.6

The following field tests shall be performed on all liquid-filled transformers. Pass-fail criteria shall be in accordance with transformer manufacturer's

a. Insulation resistance test phase-to-ground.

b. Turns ratio test.

d. Correct operation of tap changer.

3.11.7

Calibration, testing, adjustment, and placing into service of the installation shall be accomplished by a manufacturer's product field service engineer or independent testing

shall be performed on the equipment listed below. These services shall be performed subsequent to testing but prior to the initial energization. The equipment shall be

manufacturer and as shown on the detail drawings. Terminations of conductors at major equipment shall be inspected to ensure the adequacy of connections. Bare and insulated

installation. If factory tests were not performed on completed assemblies, tests shall be performed after the installation of completed assemblies. Components shall be

materials have been removed. Components capable of being both manually and electrically operated shall be operated manually prior to the first electrical operation. Components

tested in accordance with the instructions of the equipment manufacturer. Items for which such services shall be provided, but are not limited to, are the following:

a. Secondary unit substation

b. Pad-mounted transformers

c. Panelboards

d. Switchboards

e. Metal-enclosed switchgear

f. Busways

g. Switches

3.11.8 \+Operating Tests+

After the installation is completed, and at such times as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the requirements herein. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.12 MANUFACTURER'S FIELD SERVICE

3.12.1 Onsite Training

The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 24 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, and servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations. A VHS format video tape of the entire training session shall be submitted.

3.12.2 Installation Engineer

After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests, initial operation, and instruct personnel as to the operational and maintenance features of the equipment.

3.13 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

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

\-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&**
\-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-	**(<u>1998; Second Edition</u>) 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.

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.

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 andshall 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 polyethlene 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 mimimum 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-\orRHW 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 O	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

_____

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 <u>with gray finish</u>, 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 opennings 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 warrenty 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, <u>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.</u>

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 conduitrigid zinc-coated steel conduit,rigid plastic conduit,electrical metallic tubing,electrical nonmetallic tubing,orintermediate 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 \~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 \~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 o 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 shal 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-degrees bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of \~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 \~12 inch~\ 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 \~1/4 inch~\ 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 \~24 inches~\ 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 \~1/16 inch.~\ The use of sectional-type device plates will not be permitted. Plates installed in wet locations shall be gasketed and provided with a hinged, gasketed cover, unless otherwise specified.

3.5 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.

[AM#1]
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 \~hp~\ 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 \~horsepower~\ ratings and other motor requirements necessary for the applications indicated. When electrically driven equipment furnished under other sections of these specifications materially differs from the design, the Contractor shall make the necessary adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed.

3.10 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 \~1/8 hp~\ or larger shall be provided with thermal-overload protection. Polyphase motors shall have overload protection in each ungrounded conductor. The overload-protection device shall be provided either integral with the motor or controller, or shall be mounted in a separate enclosure. Unless otherwise specified, the protective device shall be of the manually reset type. Single or double pole tumbler switches specifically designed for alternating-current operation only may be used as manual controllers for single-phase motors having a current rating not in excess of 80 percent of the switch rating. Automatic control devices such as thermostats, float or pressure switches may control the starting and stopping of motors directly, provided the devices used are designed for that purpose and have an adequate \~horsepower~\ rating. When the automatic-control device does not have such a rating, a magnetic starter shall be used, with the automatic-control device actuating the pilot-control circuit. When combination manual and automatic control is specified and the automatic-control device operates the motor directly, a double-throw, three-position tumbler or rotary switch shall be provided for the manual control; when the automatic-control device actuates the pilot control circuit of a magnetic starter, the latter shall be provided with a three-position selector switch marked MANUAL-OFF-AUTOMATIC. Connections to the selector switch shall be such that only the normal automatic regulatory control devices will be bypassed when the switch is in the Manual position; all safety control

devices, such as low- or high-pressure cutouts, high-temperature cutouts, and motor-overload protective devices, shall be connected in the moor-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:

\~R in megohms = (rated voltage in kV + 1) x 1000/(length of cable in feet)~\

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.

[AM#1]
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-\&\.

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.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 16528

EXTERIOR LIGHTING

02/95

PART
1 - GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

\-AASHTO LTS-2-\	(1985; Rev 1986, 1987, 1988) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI C2-\	(1993) National Electrical Safety Code
\-ANSI C78.1-\	(1991; C78.1a) Fluorescent Lamps - Rapid-Start Types - Dimensional and Electrical Characteristics
\-ANSI C78.40-\	(1992) Mercury Lamps
\-ANSI C78.1350-\	(1990) 400-Watt, 100-Volt, S51 Single-Ended High-Pressure Sodium Lamps
\-ANSI C78.1351-\	(1989) 250-Watt, 100-Volt S50 Single-Ended High-Pressure Sodium Lamps
\-ANSI C78.1352-\	(1990) 1000-Watt, 250-Volt, S52 Single-Ended High-Pressure Sodium Lamps
\-ANSI C78.1355-\	(1989) 150-Watt, 55-Volt S55 High-Pressure Sodium Lamps
\-ANSI C78.1375-\	(1990) 400-Watt, M59 Single-Ended Metal-Halide Lamps
\-ANSI C78.1376-\	(1990) 1000-Watt, M47 Single-Ended Metal-Halide Lamps
\-ANSI C80.1-\	(1990) Rigid Steel Conduit - Zinc Coated
\-ANSI C82.4-\	(1992) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

\-ANSI C119.1-\	(1986) Sealed Insulated Underground Connector Systems Rated 600 Volts
\-ANSI C135.1-	**(1979) Galvanized Steel Bolts and Nuts for Overhead Line Construction**
\-ANSI C135.14-	**(1979) Staples with Rolled or Slash Points for Overhead Line Construction**
\-ANSI C135.30-	**(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction**
\-ANSI C136.2-	**(1985) Luminaires Voltage Classification**
\-ANSI C136.3-	**(1989) Luminaire Attachments - for Roadway Lighting Equipment**
\-ANSI C136.6-	**(1990) Roadway Lighting Equipment - Metal Heads and Reflector Assemblies - Mechanical and Optical Interchangeability**
\-ANSI C136.9-	**(1990) Roadway Lighting Equipment - Socket Support Assemblies for Metal Heads - Mechanical Interchangeability**
\-ANSI C136.10-	**(1988) Locking-type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing for Roadway Lighting Equipment**
\-ANSI C136.11-	**(1988) Multiple Sockets for Roadway Lighting Equipment**
\-ANSI C136.13-	**(1992) Metal Brackets for Wood Poles**
\-ANSI C136.15-	**(1986) High-Intensity-Discharge and Low-Pressure Sodium Lamps in Luminaires - Field Identification**
\-ANSI C136.20-	**(1990) Roadway Lighting Equipment - Fiber Reinforced Lighting Poles (FRP)**
\-ANSI O5.1-	**(1992) Specifications and Dimensions for Wood Poles**

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 36-	**(1994a) Carbon Structural Steel**
\-ASTM A 48-	**(1994a) Gray Iron Castings**
\-ASTM A 123-	**(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products**

\-ASTM A 153-	**(1982; R 1987) Zinc Coating (Hot-Dip) on Iron and Steel Hardware**
\-ASTM A 575-	**(1989) Steel Bars, Carbon, Merchant Quality, M-Grades**
\-ASTM A 576-	**(1990b) Steel Bars, Carbon, Hot-Wrought, Special Quality**
\-ASTM B 2-	**(1988) Medium-Hard-Drawn Copper Wire**
\-ASTM B 8-	**(1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft**
\-ASTM B 117-	**(1994) Operating Salt Spray (Fog) Testing Apparatus**
\-ASTM C 478-	**(1993) Precast Reinforced Concrete Manhole Sections**
\-ASTM D 1654-	**(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments**

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

\-AWPA C4-	**(1993) Poles - Preservative Treatment by Pressure Processes**
\-AWPA C25-	**(1992) Sawn Crossarms - Preservative Treatment by Pressure Processes**
\-AWPA P1/P13-	**(1991) Standard for Coal Tar Creosote for Land and Fresh Water and Marine (Coastal Water) Use**
\-AWPA P8-	**(1991) Standard for Oil-Borne Preservatives**
\-AWPA P9-	**(1992) Standard for Solvents and Formulations for Organic Preservative Systems**

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

\-EIA 232-E-	**(1991) Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange**

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

\-IESNA ARP-8-	**(1983) Roadway Lighting**

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

\-IEEE C62.41-	**(1991) Surge Voltages in Low-Voltage AC Power Circuits**
\-IEEE Std 81-	**(1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System**

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

\-NEMA 250-	**(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)**
\-NEMA ICS 1-	**(1993) Industrial Controls and Systems**
\-NEMA ICS 2-	**(1993) Industrial Control Devices, Controllers and Assemblies**
\-NEMA ICS 6-	**(1993) Enclosures for Industrial Control and Systems**
\&\-NEMA OS 1-	**(1989) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports&**
\&\-NEMA OS 2-	**(1986; Errata Aug 1986; R 1991) Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports&**
\-NEMA RN 1-	**(1989) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit**
\-NEMA TC 6-	**(1990) PVC and ABS Plastic Utilities Duct for Underground Installation**
\-NEMA TC 9-	**(1990) Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation**

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 70-	**(1993) National Electrical Code**

UNDERWRITERS LABORATORIES (UL)

\-UL 6-	**(1993) Rigid Metal Conduit**
\-UL 44-	**(1991; Rev thru Jan 1995) Rubber-Insulated Wires and Cables**
\-UL 98-	**(1994; Rev Feb 1995) Enclosed and Dead-Front Switches**
\-UL 467-	**(1993) Grounding and Bonding Equipment**

\-UL 486A-	**(1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors**
\-UL 486B-	**(1991; Rev thru Apr 1992) Wire Connections for Use with Aluminum Conductors**
\-UL 506-	**(1994; Rev Jul 1994) Specialty Transformers**
\-UL 514A-	**(1991) Metallic Outlet Boxes**
\&\-UL 514B-	**(1992; Rev thru Apr 1995) Fittings for Conduit and Outlet Boxes&**
\&\-UL 514C-	**(1988; Rev Apr 1995) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers&**
\-UL 651-	**(1989; Rev thru Dec 1989) Schedule 40 and 80 Rigid PVC Conduit**
\-UL 651A-	**(1989; Rev thru Dec 1989) Type EB and A Rigid PVC Conduit and HDPE Conduit**
\-UL 854-	**(1991; Rev thru Apr 1993) Service-Entrance Cables**
\&\-UL 886-	**(1994; Rev thru Jul 1995) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations&**
\-UL 870-	**(1991) Wireways, Auxiliary Gutters, and Associated Fittings**
\-UL 1029-	**(1994) High-Intensity-Discharge Lamp Ballasts**
\-UL 1449-	**(1985; Errata Apr 1986) Transient Voltage Surge Suppressors**
\-UL 1571-	**(1991; Rev thru Jul 1994) Incandescent Lighting Fixtures**
\-UL 1572-	**(1991; Rev thru Jul 1994) High Intensity Discharge Lighting Fixtures**

1.2 SYSTEM DESCRIPTION

1.2.1 Lighting System

The lighting system shall be configured as specified and shown. The system shall include all fixtures, hardware, poles, cables, connectors, adapters and appurtenances needed to provide a fully functional lighting system.

1.2.2 Electrical Requirements

The equipment shall operate from a voltage source as shown, plus or minus 10 percent, and 60 Hz, plus or minus 2 percent.

1.2.3 Interface Between Lighting System and Power Distribution

Conductors shall shall be as indicated.

1.2.4 Nameplates

Each major component of equipment shall have a nonferrous metal or engraved plastic nameplate which shall show, as a minimum, the manufacturer's name and address, the catalog or style number, the electrical rating in volts, and the capacity in amperes or watts.

1.2.5 Standard Products

Materials and equipment shall be standard products of manufacturer regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.2.6 Protection of Security Lighting System Components

1.2.6.1 Components and Conductors

Lighting system conductors shall be installed in raceways or by means of direct burial, as shown. Where the conductors leave the underground systems, the conductors shall be in rigid steel conduit of the indicated size. Wire guards shall be provided to protect security lighting luminaries mounted below \~20 feet.~\ A \-NEMA ICS 6-\, Type 4 enclosure shall house exterior group-located electrical equipment such as time switches, safety switches, and magnetic contactors. Where only one piece of equipment is being provided at a location, the equipment shall be provided with its own enclosure.

1.2.6.2 Tamper Provisions

Enclosures, cabinets, housings (other than luminaire housings), boxes, raceways, conduits, and fittings having hinged doors or removable covers, and which contain any part of the security lighting system (including power sources), shall be provided with corrosion-resistant tamper switches, connected to an Intrusion Detection System (IDS), that will initiate an alarm signal when the door or cover is opened or moved. Tamper switches shall be inaccessible until the switch is activated. Switch leads and mounting hardware shall be concealed from the exterior of the enclosure. For pull or junction boxes which contain no splices or connections the covers may be protected by \~1/4 inch~\ tack welds on four sides of each cover rather than by tamper switches. Labels shall be affixed to indicate they contain no connections. Labels shall not indicate that the box is part of the security system.

1.3 CORROSION PROTECTION

1.3.1 Aluminum Materials

Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to \-UL 486B-\ shall be used.

1.3.2 Ferrous Metal Materials

1.3.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with \-ASTM A 153-\ and \-ASTM A 123-\.

1.3.2.2 Equipment

Equipment and component items, including but not limited to metal poles and ferrous metal luminaires not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in \-ASTM B 117-\ without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of \~1/16 inch~\ from the test mark. The scribed test mark and test evaluation shall have a rating of not less than 7 in accordance with TABLE 1, (procedure A) of \-ASTM D 1654-\. Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

1.3.3 Finishing

Painting required for surfaces not otherwise specified and finish painting of items only primed at the factory, shall be as specified in Section \=09900=\ PAINTING, GENERAL.

1.4 SUBMITTALS

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

SD-01 Data\

Equipment and Materials\; *FIO*\.

Data published by the manufacturer of each item on the list of equipment and material, to permit verification that the item proposed is of the correct size, properly rated or applied, or is otherwise suitable for the application and fully conforms to the requirements specified.

Spare Parts\; *FIO*\.

Spare parts data for each item of material and equipment specified, after approval of detail drawings for materials and equipment, and not later than 4 months before the date of beneficial occupancy. The data shall include a complete list of parts, special tools, and supplies, with current unit prices and sources of supply.

SD-04 Drawings\

Lighting System\; *GA*\.

Detail drawings for the complete system and for poles, lighting fixtures, bracket arms, cable boxes, handholes, transformers, and controllers.
As-Built Drawings\; *FIO*\.

Final as-built drawings shall be finished drawings on mylar or vellum and shall be delivered with the final test report.

SD-09 Reports\

Operating Test\; *GA*\.

Test procedures and reports for the Operating Test. After receipt by the Contractor of written approval of the test procedures, the Contractor shall schedule the tests. The final test procedures report shall be delivered after completion of the tests.

Ground Resistance Measurements\; *FIO*\.

The measured resistance to ground of each separate grounding installation, indicating the location of the rods, the resistance of the soil in ohms per millimeter and the soil conditions at the time the measurements were made. The information shall be in writing.

SD-19 Operation and Maintenance Manuals\

Lighting System\; *FIO*\.

A draft copy of the operation and maintenance manuals, prior to beginning the tests for use during site testing. Final copies of the manuals as specified bound in hardback, loose-leaf binders, within 30 days after completing the field test. The draft copy used during site testing shall be updated with any changes required, prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and nearest service representatives for each item of equipment for each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the field test shall include modifications made during installation checkout and acceptance.

PART 2 PRODUCTS

2.1 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 BRACKET ARMS

2.2.1 On Aluminum Poles

Poles shall be provided with bracket arms of the support arm style and of the length indicated on drawings. Bracket arms shall conform to the design of the pole provided. The bracket arms shall be capable of supporting the equipment to be mounted on it with the maximum wind and ice loading encountered at the site. Strength of bracket arms shall be in accordance with \-ANSI C136.13-\. Steel brackets shall be galvanized. Wood bracket arms shall not be used.

2.2.2 Floodlight Brackets

Floodlight brackets shall be coordinated with the floodlight support provided.

2.3 CABLE

The Contractor shall provide all wire and cable not indicated as government furnished equipment. Wire and cable components shall be able to withstand the jobsite environment for a minimum of 20 years.

[AM#1]
2.3.1 Insulated Cable

Cable shall be type USE conforming to \-UL 854-\, with copper conductors and type RHW or XHHW insulation conforming to \-UL 44-\, and shall include green ground conductor. Cable shall be provided with insulation of a thickness not less than that given in column A of TABLE 15.1 of \-UL 854-\. Cable shall be rated 600 volts. Parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded.

2.3.2 Bare Copper Conductors

Medium-hard-drawn copper conductors shall conform to \-ASTM B 2-\ and \-ASTM B 8-\.

2.4 CABLE SPLICES AND CONNECTORS

Cable splices and connectors shall conform to \-UL 486A-\. Underground splices and connectors shall also conform to the requirements of \-ANSI C119.1-\.

2.5 CABLE BOXES

Boxes and covers shall be made of cast iron with zinc coated or aluminized finish, and shall be of the sizes indicated on drawings. The minimum inside dimensions shall be not less than \~12 inches~\ square by \~6 inches~\ deep and not less than required to house the cable splice. A suitable gasket shall be installed between the box and cover for watertightness. A sufficient number of screws shall be installed to hold the cover in place along the entire surface of contact. Grounding lugs shall be provided.

2.6 PULLBOXES

Pullboxes shall be as indicated. \&Strength of pullboxes and their frames and covers shall conform to the requirements of \-ANSI C2-\&\. Pullbox covers in parking lots, sidewalks, and turfed areas shall be of the same

material as the box. Concrete pullboxes shall consist of precast reinforced concrete boxes, extensions, bases, and covers.

2.7 CONDUIT, DUCTS AND FITTINGS

2.7.1 Conduit, Rigid Steel

Rigid steel conduit shall conform to \-ANSI C80.1-\ and \-UL 6-\.

2.7.2 Conduit Coatings

Underground metallic conduit and fittings shall be coated with a plastic resin system conforming to \-NEMA RN 1-\, Type 40. Epoxy systems may also be used.

2.7.3 Conduit Fittings and Outlets

2.7.3.1 Boxes, Nonmetallic, Outlet and Flush-Device Boxes and Covers

\-NEMA OS 2-\ and \-UL 514C-\.

2.7.3.2 Boxes, Switch (Enclosed), Surface Mounted

\-UL 98-\.

2.7.3.3 Fittings for Conduit and Outlet Boxes

\-UL 514B-\.

2.7.3.4 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

\-UL 514B-\.

2.7.4 Non-Metallic Duct

Non-metallic duct lines and fittings utilized for underground installation shall be suitable for the application. Duct shall be thick-wall, single, round-bore type. Material of one type shall be used. Acrylonitrile-butadiene-styrene (ABS) duct shall conform to \-NEMA TC 6-\and \-NEMA TC 9-\. High-density conduit shall conform to \-UL 651A-\. Schedule 40 polyvinyl chloride (PVC) shall conform to \-UL 651-\. Plastic utility duct and fittings manufactured without a UL label or listing shall be provided with a certification as follows: "The materials are suitable for use with \~167 degree F~\ wiring. No reduction of properties in excess of that specified for materials with a UL label or listing will be experienced if samples of the finished product are operated continuously under the normal conditions that produce the highest temperature in the duct."

[AM#1]
2.8 GROUND RODS

<u>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 earth.</u>

2.9 POLES

Metal poles shall be the pole manufacturer's standard design for supporting the number of fixtures indicated. Poles shall be designed for a wind velocity of \~70 mph~\ at the base of the pole, for a wind gust factor of 1.3, and for the height and drag factors recommended by \-AASHTO LTS-2-\. The effective projected area of luminaires and other pole-mounted devices shall be taken into account in pole design. Poles shall have grounding provisions. The type of pole shaft material provided shall not be mixed on any project. Grounding connection shall be provided near the bottom of each metal pole and at each concrete pole anchor base. Scratched, stained, chipped, or dented poles shall not be installed.

2.9.1 Aluminum Poles

Aluminum poles and brackets for lighting shall have a dark anodic bronze finish to match fixtures and shall not be painted. Manufacturer's standard provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.

a. Shafts shall be round and of seamless construction. The wall thickness shall be at least \~0.188 inch.~\ Exterior surfaces shall be free of protuberances, dents, cracks, and discoloration. Material for shafts shall be 6063 aluminum alloy; after fabrication, the alloy shall have a T6 temper. Tops of shafts shall be fitted with a round or tapered cover. Bases shall be anchor bolt mounted, made of cast aluminum alloy 356-T6, and shall be machined to receive the lower end of shafts. Joints between shafts and bases shall be welded. Bases shall be provided with four holes, spaced 90 degrees apart, for anchorage.

b. Hardware, except anchor bolts, shall be either 2024-T4 anodized aluminum alloy or stainless steel.

2.9.2 Anchor Bolts

Anchor bolts shall be the pole manufacturer's standard, but not less than necessary to meet the pole wind and ice loading, herein and other specified design requirements.

2.10 POLE LINE HARDWARE

Zinc coated hardware shall conform to \-ANSI C135.1-\ and \-ANSI C135.14-\, and steel hardware material shall conform to \-ASTM A 575-\ and \-ASTM A 576-\. Hardware shall be hot-dip galvanized in accordance with \-ASTM A 153-\.

2.11 ELECTRICAL ENCLOSURES

The Contractor shall provide metallic enclosures as needed to house the lighting equipment. Enclosures shall conform to \-NEMA ICS 6-\ and \-NEMA 250-\. Enclosures shall be provided with lockable or padlock handles. Keys for lockable enclosures shall be delivered to the Contracting Officer. The enclosures shall be as specified or as shown on the drawings.

2.11.1 Interior Enclosures

Enclosures to house lighting equipment in an interior environment shall meet the requirements of a NEMA 12 enclosure as defined in \-NEMA 250-\.

2.11.2 Exposed-to-Weather Enclosures

Enclosures to house lighting equipment in an outdoor environment shall meet the requirements of a NEMA 4 enclosure as defined in \-NEMA 250-\.

2.11.3 Corrosion Resistant Enclosures

Enclosures to house lighting equipment in a corrosive environment shall meet the requirements of a NEMA 4X enclosure as defined in \-NEMA 250-\.

2.12 ILLUMINATION

2.12.1 General Lighting

Luminaires, ballasts, lamps, and control devices required for general area lighting shall be in accordance with sheet51 of Standard Detail No. 40-06-04, attached to these specifications and those on the drawings.

2.13 LAMPS AND BALLASTS, HIGH INTENSITY DISCHARGE (HID) SOURCES

2.13.1 High-Pressure Sodium

Lamps shall conform to \-ANSI C78.1350-\ or \-ANSI C78.1351-\ or \-ANSI C78.1352-\ or \-ANSI C78.1355-\. Ballasts shall conform to \-ANSI C82.4-\, or \-UL 1029-\. High-pressure sodium lamps shall be clear.

2.14 LUMINAIRE COMPONENTS

Luminaire components shall conform to the following: attachments, \-ANSI C136.3-\; voltage classification, \-ANSI C136.2-\; field identification marking, \-ANSI C136.15-\; interchangeability, \-ANSI C136.6-\ and \-ANSI C136.9-\; and sockets, \-ANSI C136.11-\.

2.15 LIGHTING CONTROL EQUIPMENT

2.15.1 Photo-Control Devices

Photo-control devices shall conform to \-ANSI C136.10-\. Each photo-control element shall be a replaceable, weatherproof, plug-in or twist-lock assembly adjustable operation range of approximately \~0.5 to 5.0 foot-candles.~\ Luminaires shall be equipped with weatherproof plug-in or twist-lock receptacle to receive the photo-control element.

2.15.2 Manual Control Switches

Manual control switches shall conform to \-UL 98-\. The switches shall be the heavy-duty type and shall be suitable for operation on a 120 volt, 60 Hz system. The number of poles and ampere rating shall be as indicated. Switch construction shall be such that a screwdriver will be required to open the switch door when the switch is on. The selector switch shall have a minimum of three positions: ON, OFF, and AUTOMATIC. The automatic selection shall be used when photoelectric or timer control is desired. The selector switch

shall interface with the lighting system magnetic contactor and control its activity.

2.16 PHOTOMETRIC DISTRIBUTION CLASSIFICATION

Photometrics shall conform to \-IESNA ARP-8-\.

2.17 LUMINAIRES, FLOODLIGHTING

2.17.1 HID

HID lighting fixtures shall conform to \-UL 1572-\.

2.18 FIXTURES

Standard fixtures shall be as detailed on Standard Detail No. 40-06-04, Sheet Nos. 51 which accompany and form a part of this specification. Special fixtures shall be as indicated on the drawings. Illustrations shown on these sheets or on the drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures of similar design, equivalent light distribution and brightness characteristics, equal finish and quality will be acceptable as approved.

2.18.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation.

2.18.2 In-Line Fuse

An in-line fuse shall be provided for each fixture, and shall consist of a fuse and a UL approved waterproof fuse holder rated at 30 amperes, 600 volts, with insulated boots. Fuse rating shall be 600 volts.

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall install all system components, including government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, \-ANSI C2-\, and contract documents, and shall furnish necessary hardware, fixtures, cables, wire, connectors, interconnections, services, and adjustments required for a complete and operable system.

3.1.1 Current Site Conditions

The Contractor shall verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Government. The Contractor shall not take any corrective action without written permission from the Government.

3.1.2 Existing Equipment

The Contractor shall connect to and utilize existing lighting equipment and devices as shown. Lighting equipment that is usable in their original

configuration without modification may be reused with Government approval. The Contractor shall perform a field survey, including testing and inspection of existing lighting equipment and control lines intended to be incorporated into the lighting system, and furnish a report to the Government. For those items considered nonfunctioning, specification sheets, or written functional requirements to support the findings and the estimated cost to correct the deficiency shall be provided with the report. As part of the report, the Contractor shall include the scheduled need date for connection to all existing equipment. The Contractor shall make written requests and obtain approval prior to disconnecting any control lines and equipment, and creating equipment downtime. Such work shall proceed only after receiving Government approval of these requests. If any device fails after the Contractor has commenced work on that device, the Contractor shall diagnose the failure and perform any necessary corrections to the equipment. The Government is responsible for maintenance and repair of Government equipment. The Contractor shall be held responsible for repair costs due to Contractor negligence or abuse of Government equipment.

3.2 ENCLOSURE PENETRATIONS

Enclosure penetrations shall be from the bottom unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer, and in such a manner that the cable is not damaged.

3.3 PREVENTION OF CORROSION

3.3.1 Aluminum

Aluminum shall not be used in contact with earth or concrete, and where connected to dissimilar metal, shall be protected by approved fittings and treatment.

3.3.2 Steel Conduits

Steel conduits shall not be installed within concrete slabs-on-grade. Steel conduits installed underground or under slabs-on-grade, or penetrating slabs-on-grade, shall be field wrapped with \~0.010 inch~\ thick pipe-wrapping plastic tape applied with a 50 percent overlap, or shall have a factory-applied plastic resin, epoxy coating. Zinc coating may be omitted from steel conduit which has a factory-applied epoxy coating.

3.3.3 Cold Galvanizing

Field welds and/or brazing on factory galvanized boxes, enclosures, conduits, etc. shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

[AM#1]

3.4 CABLE INSTALLATION

Cable and all parts of the cable system such as splices and terminations shall be rated not less than 600 volts. The size and number of conductors and the number of cables shall be as indicated. Conductors larger than No. 8 AWG shall be stranded. Each circuit shall be identified by means of fiber or nonferrous metal tags, or approved equal, in each handhole and junction box, and at each terminal.

3.4.1 Splices

Splices below grade shall be made with nonpressure-filled resin systems using transparent, interlocking, self-venting, longitudinally split plastic molds. Splices above grade shall be made with sealed insulated pressure connectors and shall provide insulation and jacket equal to that of the cable. In order to prevent moisture from entering the splice, jackets shall be cut back to expose the required length of insulation between the jacket and the tapered end of the insulation.

3.4.2 Installation in Duct Lines

Ground conductors shall be installed in duct with the associated phase conductors.

3.4.3 Direct Burial

Minimum cover from top of cable to finished grade shall be \~30 inches~\ for direct buried cable, but not less than the depth of the frost line.

3.4.3.1 Trenching

Trenches shall be excavated to the depths required to provide the minimum cable cover. The bottom of the trench shall be smooth and free of stones and sharp objects. Where the bottom of the trench consists of material other than sand or earth, an additional \~3 inch~\ layer shall be removed and replaced by a \~3 inch~\ layer of sand or stone-free earth compacted to the approximate density of the surrounding firm soil. The cables shall be unreeled in place along the side of or in the trench and carefully placed on the sand or earth bottom. Pulling cables into a direct-burial trench from a fixed reel position will not be permitted. Where cables cross, a separation of at least \~3 inches~\ shall be provided, unless the cables are protected by nonmetallic conduit sleeves at the crossing. The radius of bends in cables shall be not less than 12 times the diameter of the cable. Cables shall not be left under longitudinal tension. The first layer of backfill shall be \~6 inches~\ thick and shall consist of sand or stone-free earth. One-inch untreated planks, not less than \~8 inches~\ in width, or approved equal protection, shall be placed end to end along the cable run, approximately \~3 inches~\ above the cable. A \~5 mil,~\ brightly colored plastic tape not less than \~3 inches~\ in width and suitably inscribed at not more than \~10 feet~\ on centers, or other approved dig-in warning indication, shall be placed approximately \~12 inches~\ below finished grade levels of trenches. Selected backfill of sand or stone-free earth shall be provided to a minimum depth of \~3 inches~\ above cables.

3.4.3.2 Requirements for Installation in Duct

Where indicated on drawing, cable shall be installed in duct lines. Ground and neutral conductors shall be installed in duct with the associated phase

conductors. The segments of direct-burial cable that cross under new railroad tracks, roads, or paving exceeding \~5 feet~\ in width, shall be installed in plastic, or rubber duct encased in concrete in accordance with paragraph DUCT LINES. Pulling of cable into conduit from a fixed reel position will be permitted. At interfaces with direct-burial cable, the direct-burial cable shall be centered in the entrance to the duct, using an approved waterproof, nonhardening mastic compound to facilitate the centering. Where crossing existing railroad tracks, coated rigid steel conduit shall be installed under the tracks, in lieu of concrete-encased duct, in accordance with paragraph DUCT LINES. Installation shall be in accordance with \-NFPA 70-\ and the regulations of the railroad.

3.4.3.3 Location of Cable Splices

Splices in direct-burial cable will not be permitted in runs of \~500 feet~\ or less or at intervals of less than \~500 feet~\ in longer runs except as required for taps. Where cable splices in shorter intervals are required to avoid obstructions or damage to the cable, the location shall be as approved. Cable splices shall be installed in cable boxes or concrete handholes.

3.4.3.4 Markers

Cable and cable splice markers shall be located near the ends of cables, at each cable splice, approximately every \~400 feet~\ along the cable run, and at changes in direction of the cable run. Markers need not be placed along cables laid in relatively straight lines between lighting poles that are spaced less than \~400 feet~\ apart. Markers shall be placed approximately \~2 feet~\ to the right of the cable or cable splice when facing the longitudinal axis of the cable in the direction of the electrical load. The marker shall be concrete with a 28 day compressive strength of \~2500 psi~\ in accordance with Section \=03300=\ CONCRETE FOR BUILDING CONSTRUCTION. The letter "C" shall be impressed in the top of each marker.

3.4.3.5 Warning Tape

Direct burial cable shall be placed below a plastic warning tape buried in the same trench or slot. A \~5 mil~\ brightly colored plastic tape, not less than \~3 inches~\ in width and suitably inscribed at not more than \~10 feet~\ on centers with a continuous metallic backing and a corrosion-resistant \~1 mil~\ metallic foil core to permit easy location of the buried cable, shall be placed approximately \~12 inches~\below finished grade.

[AM#1]
3.5 CONNECTIONS TO BUILDINGS

Cables shall be extended into the various buildings as indicated and shall be properly connected to the indicated equipment. Empty conduits to the indicated equipment from a point \~5 feet~\ outside the building wall and \~2 feet~\ below finished grade shall be provided. After installation of cables, conduits shall be sealed to prevent moisture or gases from entering the building.

3.6 DUCT LINES

3.6.1 Requirements

Numbers and size of ducts shall be as indicated. Duct lines shall be laid with a minimum slope of \~4 inches per 100 feet.~\Depending on the contour of the finished grade, the high point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short radius manufactured 90 degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be \~18 inches~\ for ducts of less than \~3 inches~\ in diameter, and \~36 inches~\ for duct \~3 inches~\or greater in diameter. Otherwise, long sweep bends having a minimum radius of \~25 feet~\ shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells when duct lines terminate in manholes or handholes.

3.6.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and shall match factory tapers. A coupling recommended by the duct manufacturer shall be used when an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.6.3 Concrete Encasement

Ducts requiring concrete encasements shall comply with \-NFPA 70-\ except that electrical duct bank configurations for ducts \~6 inches~\ in diameter shall be determined by calculation and as shown on the drawings. Duct line encasements shall be monolithic construction. Where a connection is made to a previously poured encasement, the new encasement shall be well bonded or doweled to the existing encasement. At any point, except railroad and airfield crossings, tops of concrete encasements shall not be less than the cover requirements listed in \-NFPA 70-\. At railroad and airfield crossings, duct lines shall be encased with concrete and reinforced as indicated to withstand specified surface landings. Tops of concrete encasement shall not be less than \~5 feet~\ below tops of rails or airfield paving unless otherwise indicated. Where ducts are jacked under existing pavement, rigid steel conduit shall be installed. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than \~50 feet~\ in length, the predrilling method or the jack-and-sleeve method shall be used. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not more than \~4 foot~\ on centers. Ducts shall be securely anchored to prevent movement during the placement of concrete, and joints shall be staggered at least \~6 inches~\ vertically.

3.6.4 Nonencased Direct-Burial

Top of duct lines shall be below the frost line depth not less than \~24 inches~\below finished grade and shall be installed with a minimum of \~3 inches~\ of earth around each duct, except that between adjacent electric

power and communication ducts, \~12 inches~\ of earth is required. Bottom of trenches shall be graded toward manholes or handholes and shall be smooth and free of stones, soft spots, and sharp objects. Where bottoms of trenches comprise materials other than sand, a \~ 3 inch~\ layer of sand shall be laid first and compacted to approximate densities of surrounding firm soil before installing ducts. Joints in adjacent tiers of duct shall be vertically staggered at least \~6 inches.~\ The first \~6 inch~\ layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in \~3 to 6 inch~\layers. Duct banks may be held in alignment with earth. However, high tiered banks shall use a wooden frame or equivalent form to hold ducts in alignment prior to backfilling.

3.6.5 Installation of Couplings

Joints in each type of duct shall be made up in accordance with the manufacturer's recommendation for the particular type of duct and coupling selected and as approved.

3.6.5.1 Plastic Duct

Duct joints shall be made by brushing a plastic solvent on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4 turn to set the joint tightly.

3.6.6 Concrete

Concrete work shall be as specified in Section \=03300=\ CONCRETE FOR BUILDING CONSTRUCTION. Concrete shall be plain, \~2500 psi~\ at 28 days, except that reinforced concrete shall be \~3000 psi~\ at 28 days. Duct line encasement shall be of monolithic construction. Where a connection is made to an existing duct line, the concrete encasement shall be well bonded or doweled to the existing encasement.

[AM#1]
3.6.7 Duct Line Markers

<u>Duct line markers shall be provided at the ends of long duct line stubouts or for other duct locations that are indeterminate because of duct curvature or terminations at completely below-grade structures.</u> In addition to markers, a \~5 mil~\brightly colored plastic tape, not less than \~3 inches~\ in width and suitably inscribed at not more than \~10 feet~\ on centers with a continuous metallic backing and a corrosion-resistant \~1 mil~\ metallic foil core to permit easy location of the duct line, shall be placed approximately \~12 inches~\ below finished grade levels of such lines.

- - o 0 o - -

3.7 POLE INSTALLATION

Pole lengths shall provide a luminaire mounting height as shown on the drawings. The mount interfaces shall have ac power connected, and the pole wiring harness shall be connected to the luminaire. Light poles shall not be installed outside the site or inside the perimeter zone. Pole installation shall conform to the manufacturer's recommendations, \-NFPA 70-\, and \-ANSI C2-\. Poles shall be set straight and plumb.

3.7.1 Concrete Foundations

Concrete foundations shall have anchor bolts accurately set in the foundation using a template supplied by the pole manufacturer. Once the concrete has cured, the pole shall be set on the foundation, leveled on the foundation bolts, and secured with the holding nuts. The space between the foundation and the pole base shall be grouted. Concrete and grout work shall conform to Section \=03300=\ CONCRETE FOR BUILDING CONSTRUCTION. Concrete shall be \~3000 psi~\ at 28 days.

3.7.2 Aluminum Pole Installation

Poles shall be mounted on cast-in-place or power-installed screw foundations. Conduit elbows shall be provided for cable entrances into pole interiors.

3.7.2.1 Cast-In-Place Foundations

Concrete foundations, sized as indicated, shall have anchor bolts accurately set in foundations using templates supplied by the pole manufacturer. Concrete work and grouting is specified in Section \=03300=\CONCRETE FOR BUILDING CONSTRUCTION. After the concrete has cured, pole anchor bases shall be set on foundations and leveled by shimming between anchor bases and foundations or by setting anchor bases on leveling nuts and grouting. Poles shall be set plumb. Anchor bolts shall be the manufactures standard, and not less than necessary to meet the pole wind loading and other specified design requirements.

3.7.2.2 Power-Installed Screw Foundations

Power-installed screw foundations having the required strength mounting bolt, and top plate dimensions may be utilized. Screw foundations shall be of at least)\~ 1/4 inch~\ thick structural steel conforming to \-ASTM A 36-\ and hot-dip galvanized in accordance with \-ASTM A 123-\. Conduit slots in screw foundation shafts and top plates shall be marked to indicate orientation. Design calculations indicating adequate strength shall be approved before installation of any screw foundation is permitted.

3.8 LIGHTING

3.8.1 Lamps

Lamps of the proper type, wattage, and voltage rating shall be delivered to the project in the original containers and installed in the fixtures just before completion of the project.

3.8.2 Fixture Installation

Standard fixtures shall be installed as detailed on Standard Detail No. 04-06-04, Sheet Nos. 51, which accompany and form a part of this specification. Special fixtures shall be as indicated on drawings. Illustrations shown on these sheets or on the drawings are indicative of the general type desired and are not intended to restrict selection of fixtures to any particular manufacturer. Fixtures of similar design, equivalent light-distribution and brightness characteristics, and equal finish and quality will be acceptable as approved.

3.8.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be installed as required for proper installation.

3.8.2.2 In-Line Fuses

An in-line fuse shall be provided for each fixture.

3.8.2.3 Special Fixtures

The types of special fixtures are designated by letters and numbers. For example, SP-1 denotes special type 1.

3.9 LIGHTING CONTROL SYSTEM

[AM#1]
3.9.1 Photo-Control

Lighting luminaires shall be controlled by a single photo-control element.

3.9.2 Manual and Safety Switches

Terminal lugs shall be coordinated with the wire size. Switches shall be securely fastened to the supporting structure or wall using not less than four \~1/4 inch~\ bolts. The use of sheet metal screws will not be allowed.

3.9.3 Magnetic Contactors

Terminal lugs shall be coordinated with the wire size. Switches shall be securely fastened to the supporting structure or wall using not less than four \~1/4 inch~\ bolts. The use of sheet metal screws will not be allowed.

[AM#1]
3.10 GROUNDING

Grounding shall be in conformance with \-NFPA 70-\, the contract drawings, and the following. Grounding conductors shall be soft-drawn, stranded copper. Ground rods shall be driven into the earth so that after the installation is complete, the top of the ground rod will be approximately \~1 foot~\ below finished grade, except in handholes. Butt grounds shall not be used.

3.10.1 Ground Rods and Pole Butt Electrodes

The resistance to ground shall be measured using the fall-of-potential method described in \-IEEE Std 81-\. The maximum resistance of a driven ground rod shall not exceed 25 ohms under normally dry conditions. Whenever the required ground resistance is not met, additional electrodes shall be provided interconnected with grounding conductors to achieve the specified ground resistance. The additional electrodes shall be up to three, \~10 feet~\ rods spaced a minimum of \~120 feet~\ apart or a single extension-type rod, \~3/4 inch~\ diameter, up to \~30 feet~\ long, 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.

3.10.2 Items to be Grounded

Ground conductors, metallic conduits, junction boxes, and noncurrent-carrying metallic parts of equipment shall be grounded. Connections above grade shall be made with solderless connectors, and those below grade shall be made by a fusion-welding process.

[AM#1]
3.10.3 Lighting Pole

One ground rod shall be provided at each pole. Bases of metal or concrete lighting poles shall be connected to ground rods by means of No. 6 AWG bare copper wire. Lighting fixture brackets on wood and concrete poles shall be grounded to a No. 6 AWG bare copper grounding conductor connected to the ground rod.

3.10.4 Metal Cable Boxes

Metal cable boxes for direct-burial cable shall be connected to adjacent ground rods by wires with current-carrying capacities of at least 20 percent of the spliced phase conductors, but not less than No. 6 AWG.

3.11 TESTS

3.11.1 \+Operating Test+

After the installation is completed and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements specified. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish instruments and personnel required for the test, and the Government will furnish the necessary electric power.

3.11.2 Ground Resistance Measurements

The resistance to ground shall be measured by the fall-of-potential method described in \-IEEE Std 81-\.

The contractor shall maintain a separate set of drawings, elementary diagrams and wiring diagrams of the lighting to be used for "as-built" drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the lighting system. In addition to being complete and accurate, this set of drawings shall be kept neat and shall not be used for installation purposes. Upon completion of the as-built drawings, a representative of the Government will review the as-built work with the Contractor. If the as-built work is not complete, the Contractor will be so advised and shall complete the work as required.

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 16670

LIGHTNING PROTECTION SYSTEM

12/88

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI C135.30-\	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 70-\	(1990) National Electrical Code
\-NFPA 780-\	(1992) Lightning Protection Code

UNDERWRITERS LABORATORIES (UL)

\-UL-03-\	(1992) Electrical Construction Materials Directory
\-UL 96-\	(1985; Rev thru Dec 1988) Lightning Protection Components
\-UL 96A-\	(1982; Rev thru Jul 1990) Installation Requirements for Lightning Protection Systems
\-UL 467-\	(1984; Rev thru Nov 1986) Grounding and Bonding Equipment
\&\-UL 486A-\	(1991; R Oct 91) Wire Connectors and Soldering Lugs for Use with Copper Conductors&\

1.2 GENERAL REQUIREMENTS

1.2.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work. No departures shall be made without the prior approval of the Contracting Officer.

1.2.2 System Requirements

The system furnished under this specification shall consist of the standard products of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest UL approved design. **The lightning protection system shall conform to \-NFPA 70-\ and \-NFPA 780-\, \-UL 96-\ and \-UL 96A-\, except where requirements in excess thereof are specified herein.**

1.3 SUBMITTALS

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

SD-04 Drawings\

Lightning Protection System\; *FIO*\.

Detail drawings consisting of a complete list of material, including manufacturer's descriptive and technical literature, catalog cuts, drawings, and installation instructions. Detail drawings shall demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

SD-13 Certificates\

Materials and Equipment\; *FIO*\.

Where material or equipment is specified to comply with requirements of UL, proof of such compliance. The label of or listing in \-UL-03-\ will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters Laboratories may be submitted. A letter of findings shall be submitted certifying UL inspection of lightning protection systems provided.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General Requirements

No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversize conductors shall be used. Where a mechanical hazard is involved, the conductor size shall be increased to compensate for the hazard or the conductors shall be protected by covering them with molding or tubing made of wood or nonmagnetic material. When metallic conduit or tubing is used, the conductor shall be electrically connected at the upper and lower ends.

2.1.2 Main and Secondary Conductors

Conductors shall be in accordance with \-NFPA 780-\ and \-UL 96-\ for Class I, Class II, or Class II modified materials as applicable.

2.1.2.1 Copper

Copper conductors used on nonmetallic stacks shall weigh not less than\~ 375 pounds per thousand feet,~\ and the size of any wire in the cable shall be not less than No. 15 AWG. The thickness of any web or ribbon used on stacks shall be not less than No. 12 AWG. Counterpoise shall be copper conductors not smaller than No. 1/0 AWG.

2.1.2.2 Aluminum

Aluminum shall not contact the earth nor shall it be used in any other manner that will contribute to rapid deterioration of the metal. Appropriate precautions shall be observed at connections with dissimilar metals. Aluminum conductors for bonding and interconnecting metallic bodies to the main cable shall be at least equivalent to strength and cross-sectional area of a No. 4 AWG aluminum wire. If perforated strips are used, the strips shall be as much wider than solid strips, as the diameter of the perforations. Aluminum strip for connecting exposed water pipes shall be not less than No. 12 AWG in thickness and at least \~1-1/2 inches~\ wide.

2.1.3 Air Terminals

Terminals shall be in accordance with \-UL 96-\ and \-NFPA 780-\. The tip of air terminals on buildings used for manufacturing, processing, handling, or storing explosives, ammunition, or explosive ingredients shall be a minimum of \~2 feet~\ above the ridge parapet, ventilator or perimeter. On open or hooded vents emitting explosive dusts or vapors under natural or forced draft, air terminals shall be a minimum of\~ 5 feet~\ above the opening. On open stacks emitting explosive dusts, gases, or vapor under forced draft, air terminals shall extend a minimum of\~ 15 feet~\ above vent opening. Air terminals more than\~ 24 inches~\ in length shall be supported by a suitable brace, with guides, not less than one-half the height of the terminal.

2.1.4 Ground Rods

Rods made of copper-clad steel shall conform to \-UL 467-\ and galvanized ferrous rods shall conform to \-ANSI C135.30-\. Ground rods shall be not less than\~ 3/4 inch~\ in diameter and \~10 feet~\ in length. Ground rods of copper-clad steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the job.

2.1.5 Clamp-Type Connectors

Connectors for splicing conductors shall conform to \-UL 96-\, class as applicable, and \&\-UL 486A-\&\, Class 2, style and size as required for the installation.

2.1.6 Lightning Protection Components

Lightning protection components, such as bonding plates, air terminal supports, chimney bands, clips, and fasteners shall conform to \-UL 96-\, classes as applicable.

PART 3 EXECUTION

3.1 INTEGRAL SYSTEM

3.1.1 General Requirements

The lightning protection system shall consist of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground. All conductors on the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

[AM#1]
3.1.1.1 Air Terminals

Air terminal design and support shall be in accordance with \-NFPA 780-\. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than\~ 2 feet~\ from the ends of the ridge or edges and corners of roofs. Spacing of air terminals\~ 2 feet~\ in height on ridges, parapets, and around the perimeter of buildings with flat roofs shall not exceed\~ 25 feet.~\ In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than\~ 2 inches~\ for each\~ foot~\ of increase over\~ 25 feet.~\ On large, flat or gently sloping roofs, as defined in \-NFPA 780-\, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding\~ 50 feet~\ in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom thereof. Where nonmetallic spires, steeples, or ventilators are prsent, air terminals shall be mounted thereon or to the side. In addition, where spires or steeples project more than\~ 10 feet~\above the building, the conductor between the air terminal <u>and metal roof shall</u> be continued to the nearest down conductor and securely connected thereto.

3.1.1.2 Roof Conductors

Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than\~ 8 inches.~\ Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every\~ 3 feet~\ along the

roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

3.1.1.3 Down Conductors

Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as widely separated as practicable, at diagonally opposite corners. On rectangular structures having gable, hip, or gambrel roofs more \~ 110 feet~\ long, there shall be at least one additional down conductor for each additional\~ 50 feet~\ of length or fraction thereof. On rectangular structures having French, flat, or sawtooth roofs exceeding\~ 250 feet~\ in perimeter, there shall be at least one additional down conductor for each\~ 100 feet~\ of perimeter or fraction thereof. On an L- or T-shaped structure, there shall be at least one additional down conductor; on an H-shaped structure, at least two additional down conductors; and on a wing-built structure, at least one additional down conductor for each wing. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than\~ 100 feet.~\ On structures exceeding\~ 50 feet~\ in height, there shall be at least one additional down conductor for each additional\~ 60 feet~\ of height or fraction thereof, except that this application will not cause down conductors to be placed about the perimeter of the structure at intervals of less than\~ 50 feet.~\ Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors ending at air terminals, except where the air terminal is on a roof below the main protected level and the "dead end" or branch conductor is less than\~ 16 feet~\ in length and maintains a horizontal or downward coursing. Down conductors shall be equall and symmetrically spaced about the perimeter of the structure. Down conductors shall be protected where necessary, to prevent mechanical injury to the conductor.

3.1.1.4 Interconnection of Metallic Parts

Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

3.1.1.5 Ground Connections

Ground connections comprising continuations of down conductors from the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection

for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

3.1.1.6 Grounding Electrodes

A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than\~ 10 feet.~\ Ground rods shall be set not less than\~ 3 feet,~\ nor more than\~ 8 feet,~\ from the structures foundation. The complete installation shall have a total resistance to ground of not more than 25 ohms. Ground rods shall be tested individually prior to connection to the system and the system as a whole shall be tested not less than 48 hours after rainfall. When the resistance of the complete installation exceeds the specified value or two ground rods individually exceed 25 ohms, the Contracting Officer will be notified immediately. A counterpoise, where required, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than\~ 2 feet~\ deep at a distance not less than\~ 3 feet~\ nor more than\~ 8 feet~\ from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous. Where so indicated on the drawings, an alternate method for grounding electrodes in shallow soil shall be provided by digging trenches radially from the building. The lower ends of the down conductors or their equivalent in the form of metal strips or wires are then buried in the trenches.

3.1.2 Steel Frame Building

The steel framework shall be made electrically continuous. Electrical continuity may be provided by bolting, riveting, or welding steel frame, unless a specific method is noted on the drawings. The air terminals shall be connected to the structural steel framework at the ridge. Short runs of conductors shall be used as necessary to join air terminals to the metal framework so that proper placing of air terminals is maintained. Separate down conductors from air terminals to ground connections are not required. Where a grounded metal pipe water system enters the building, the structural steel framework and the water system shall be connected at the point of entrance by a ground connector. Connections to pipes shall be by means of ground clamps with lugs. Connections to structural framework shall be by means of nut and bolt or welding. All connections between columns and ground connections shall be made at the bottom of the steel columns. Ground connections to grounding electrons or counterpoise shall be run from not less than one-half of all the columns distributed equally around the perimeter of the structure at intervals averaging not more than\~ 60 feet.~\

3.1.3 Post Tensioning Systems

On construction utilizing post tensioning systems to secure precast concrete sections, the post tension rods shall not be used as a path for lightning to ground. Down conductors shall be provided on structures using post tensioning systems; down conductors shall have sufficient separation from post tension

rods to prevent side-flashing. Post tension rods shall be bonded to the lightning protection and grounding systems only at the base of the structure; this bonding shall be performed in strict accordance with the recommendations of the post tension rod manufacturer, and shall be done by, or in the presence of, a representative of the manufacturer.

3.2 INTERCONNECTION OF METAL BODIES

Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. All metal bodies of conductance having an area of\~ 400 square inches~\or greater or a volume of~ 1000 cubic inches~\ or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than\~ 3 square inches.~\ Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lightning protection system using secondary bonding conductors and fittings. A metal body that exceeds\~ 5 feet~\ in any dimension, that is situated wholly within a building, and that does not at any point come within\~ 6 feet~\ of a lightning conductor or metal connected thereto shall be independently grounded.

3.3 INSPECTION

The lightning protection system will be inspected by the Contracting Officer to determine conformance with the requirements of this specification. No part of the system shall be concealed until so authorized by the Contracting Officer.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 16710

PREMISES DISTRIBUTION SYSTEM

04/97

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.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

\-EIA ANSI/TIA/EIA-568-A-\	(1995) Commercial Building Telecommunications Cabling Standard
\-EIA ANSI/TIA/EIA-569-\	\&(1996)&\ Commercial Building Standard for Telecommunications Pathways and Spaces
\-EIA ANSI/TIA/EIA-606-\	(1993) Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
\-EIA ANSI/TIA/EIA-607-\	(1994) Commercial Building Grounding and Bonding Requirements for Telecommunications
\-EIA TSB 67-\	(1995) Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems

IBM PUBLICATION CORPORATION (IBM)

\-IBM GA27-3361-07-\	(1987) LAN Cabling System - Planning and Installation
\&\-IBM GA27-3773-0-\&\	(1987) Cabling System Technical Interface Specifications

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

\-ICEA S-80-576-\	(1994) Communications Wire and Cable for Wiring of Premises
\-ICEA S-83-596-\	(1994) Fiber Optic Premises Distribution Cable

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 70-\	\&(1996; Errata)&\ National Electrical Code

UNDERWRITERS LABORATORY (UL)

\-UL 50-\	\&(1995; Rev thru Oct 1997)&\ Enclosures for Electrical Equipment
\-UL 497-	**(1995; Rev Mar 1996) Protectors for Paired Conductor Communication Circuits**

1.2 SYSTEM DESCRIPTION

The premises distribution system shall consist of inside-plant horizontal, riser, and backbone cables and connecting hardware to transport telephone and data (including LAN) signals between equipment items in a building.

1.3 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of\~ 32 to 140 degrees F~\ and in the range of 0 to 95 percent relative humidity, noncondensing.

1.4 *QUALIFICATIONS*\

1.4.1 Minimum Contractor Qualifications

All work under this section shall be performed by and all equipment shall be furnished and installed by a certified Telecommunications Contractor, hereafter referred to as the Contractor. With the exception of furnishing and installing conduit, electrical boxes, and pullwires, this work shall not be done by the Electrical Contractor. The Contractor shall have the following qualifications in Telecommunications Systems installation:

a. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.

b. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products. General electrical trade staff (electricians) shall not be used for the installation of the premises distribution system cables and associated hardware.

c. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.4.2 Minimum Manufacturer Qualifications

The equipment and hardware provided under this contract will be from manufacturers that have a minimum of 3 years experience in producing the types of systems and equipment specified.

1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The

following shall be submitted in accordance with Section \=01330=\ SUBMITTAL PROCEDURES:

SD-01 Data\

Spare Parts\; *FIO*\.

Lists of spare parts, tools, and test equipment for each different item of material and equipment specified, after approval of detail drawings, not later than 2 months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking.

SD-04 Drawings\

Premises Distribution System\; *GA*\.

Detail drawings including a complete list of equipment and material. Detail drawings shall contain complete wiring and schematic diagrams and other details required to demonstrate that the system has been coordinated and will function properly as a system. Drawings shall include vertical riser diagrams, equipment rack details, elevation drawings of telecommunications closet walls, outlet face plate details for all outlet configurations, sizes and types of all cables, conduits, and cable trays. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation.

Record Drawings\; *GA*\.

Record drawings for the installed wiring system infrastructure per \-EIA ANSI/TIA/EIA-606-\. The drawings shall show the location of all cable terminations and location and routing of all backbone and horizontal cables. The identifier for each termination and cable shall appear on the drawings.

SD-06 Instructions\

Manufacturer's Recommendations\; *GA*\.

Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations, prior to installation shall be provided. Installation of the item will not be allowed to proceed until the recommendations are received and approved.

SD-08 Statements\

Test Plan\; *GA*\.

Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications,60 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.

Qualifications\; *GA*\.

The qualifications of the Manufacturer, Contractor, and the Installer to perform the work specified herein. This shall include proof of the minimum qualifications specified herein.

SD-09 Reports\

Test Reports\; *FIO*\.

Test reports in booklet form with witness signatures verifying execution of tests. Test results will also be provided on\~ 3-1/2 inch~\ diskettes in ASCII format. Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. Test reports shall be submitted within 14 days after completion of testing.

SD-13 Certificates\

Premises Distribution System\; *FIO*\.

Written certification that the premises distribution system complies with the \-EIA ANSI/TIA/EIA-568-A-\, \-EIA ANSI/TIA/EIA-569-\, and \-EIA ANSI/TIA/EIA-606-\ standards.

Materials and Equipment\; *FIO*\.

Where materials or equipment are specified to conform, be constructed or tested to meet specific requirements, certification that the items provided conform to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

Installers\; *GA*\.

The Contractor shall submit certification that all the installers are factory certified to install and test the provided products.

SD-18 Records\

Record Keeping and Documentation\; *GA*\.

Documentation on cables and termination hardware in accordance with \-EIA ANSI/TIA/EIA-606-\.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust or other contaminants.

1.7 OPERATION AND MAINTENANCE MANUALS

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a

part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

1.8 *RECORD KEEPING AND DOCUMENTATION*

1.8.1 Cables

A record of all installed cable shall be provided on electronic media using Windows based computer cable management software per \-EIA ANSI/TIA/EIA-606-\. A licensed copy of the cable management software including documentation, shall be provided. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility per \-EIA ANSI/TIA/EIA-606-\.

1.8.2 Termination Hardware

A record of all installed patch panels and outlets shall be provided on electronic media using Windows based computer cable management software per \-EIA ANSI/TIA/EIA-606-\. A licensed copy of the cable management software including documentation, shall be provided. The hardware records shall include only the required data fields per \-EIA ANSI/TIA/EIA-606-\.

PART 2 PRODUCTS

2.1 *MATERIALS AND EQUIPMENT*

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to installation. Materials and equipment shall conform to the respective publications and other requirements specified below and to the applicable requirements of \-NFPA 70-\.

2.2 UNSHIELDED TWISTED PAIR CABLE SYSTEM

2.2.1 Cable Insulation

For each individual Category 5 cable, the insulation, material used on each pair shall be exactly the same in all physical, electrical, and chemical respects. The use of Teflon insulated, plenum rated Category 5 cable is acceptable for both plenum and non-plenum applications. If Teflon insulated plenum rated cable is used by the Contractor, it shall be Type 4x0, where all four pairs are Teflon insulated. Type 3x1 and 2x2 are not acceptable.

2.2.2 Horizontal Cable

Horizontal cable shall meet the requirements of \-EIA ANSI/TIA/EIA-568-A-\ for Category 5 horizontal cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Conductors shall be solid untinned copper 24 AWG. Cable shall be rated CMG per \-NFPA 70-\.

2.2.3 Connecting Hardware

Connecting and cross-connecting hardware shall be the same category as the cable it serves. Hardware shall be in accordance with and \-EIA ANSI/TIA/EIA-568-A-\.

2.2.3.1 Telecommunications Outlets

Wall and floor outlet plates shall be as shown on the drawings. Modular jacks shall be the same category as the cable they terminate and shall meet the requirements of \-EIA ANSI/TIA/EIA-568-A-\. Modular jack pin/pair configuration shall be T568B per \-EIA ANSI/TIA/EIA-568-A-\. Modular jacks shall be unkeyed. Faceplates shall be provided and shall be ivory in color, impact resistant plastic. Mounting plates shall be provided for system furniture and shall match the system furniture in color. Outlet assemblies used in the premises distribution system shall consist of modular jacks assembled into both simplex and duplex outlet assemblies in single or double gang covers as indicated on the drawings. The modular jacks shall conform to the requirements of \-EIA ANSI/TIA/EIA-568-A-\, Category .

2.2.3.2 Patch Panels

Patch panels shall consist of eight-position modular jacks, with rear mounted type 110 insulation displacement connectors, arranged in rows or columns on \~ 19 inch~\ rack mounted or \~ 23 inch~\ rack mounted as indicated on drawings. panels. Jack pin/pair configuration shall be T568B per \-EIA ANSI/TIA/EIA-568-A-\. Jacks shall be unkeyed. Panels shall be labeled with alphanumeric x-y coordinates.

2.2.3.3 Terminal Blocks

Terminal blocks shall be wall mounted or rack mounted as indicated on drawings wire termination units consisting of insulation displacement connectors mounted in plastic blocks, frames or housings. Blocks shall be type 110 which meet the requirements of \-EIA ANSI/TIA/EIA-568-A-\ for category 5. Blocks shall be mounted on standoffs and shall include cable management hardware. Insulation displacement connectors shall terminate 22 or 24 gauge solid copper wire as a minimum, and shall be connected in pairs so that horizontal cable and connected jumper wires are on separate connected terminals.

2.3 PROTECTOR MODULES

The protector modules shall be of the two-element gas tube type. Protection modules shall be maximum duty, A>20 kA, B>1000, C>200A where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current per \-ANSI C62.61-\. The gas modules shall shunt high voltage to ground, fail short, be equipped with an external spark gap and heat coils, and shall comply with \-UL 497-\.

2.4 FIBER OPTIC CABLE SYSTEM

2.4.1 Backbone Cable

2.4.1.1 Multimode

Multimode fiber optic backbone cable shall meet the requirements of \-EIA ANSI/TIA/EIA-568-A-\ and \-ICEA S-83-596-\ for 62.5/125 micrometer multimode graded index optical fiber cable. Numerical aperture for each fiber shall be

a minimum of 0.275. Cable construction shall be tight buffered type. Individual fibers shall be color coded for identification. Cable shall be imprinted with fiber count and aggregate length at regular intervals. Cable shall be rated OFNG per \-NFPA 70-\.

2.4.1.2 Singlemode

Singlemode fiber optic backbone cable shall meet the requirements of \-ICEA S-83-596-\ and the following: operation at a center wavelength of 1310 and 1550 nm; core/cladding diameter 8.3 nominal/125 micrometer; maximum attenuation 2.0 dB/km at 1300 nm, 1.75 dB/km at 1550 nm. Numerical aperture for each fiber shall be a minimum of 0.10. Cable construction shall be tight buffered type. Cable shall be imprinted with fiber count and aggregate length at regular intervals. Individual fibers shall be color coded for identification. Cable shall be rated OFNG per \-NFPA 70-\.

2.4.2 Horizontal Distribution Cable

[AM#1]
2.4.2.1 Multimode

Multimode fiber optic horizontal cable shall meet the requirements of \-EIA ANSI/TIA/EIA-568-A-\ and \-ICEA S-83-596-\ for 62.5/125 micrometer multimode graded index optical fiber cable. Numerical aperture for each fiber shall be a minimum of 0.275. Cable construction shall be tight buffered type, two strands. Individual fibers shall be color coded for identification. Cable shall be imprinted with fiber count, fiber type, and aggregate length at regular intervals of\~3 feet.~\ Cable shall be rated and marked OFNG per \-NFPA 70-\.

2.4.2.2 Singlemode

Singlemode fiber optic horizontal cable shall meet the requirements of \-ICEA S-83-596-\ and the following: operation at a center wavelength of 1310 and 1550 nm; core/cladding diameter 8.3 nominal/125 micrometer; maximum attenuation 2.0 dB/km at 1300 nm, 1.75 dB/km at 1550 nm. Numerical aperture for each fiber shall be a minimum of 0.10. Cable construction shall be tight buffered type, two strands. Individual fibers shall be color coded for identification. Cable shall be imprinted with fiber count, fiber type, and aggregate length at regular intervals of\~ 3 feet.~\ Cable shall be rated and marked OFNG per \-NFPA 70-\.

2.4.3 Connecting Hardware

2.4.3.1 Connectors

Connectors shall be ST type with ceramic ferrule material with a maximum insertion loss of .5 dB. Connectors shall meet performance requirements of \-EIA ANSI/TIA/EIA-568-A-\. Connectors shall be field installable. Connectors shall utilize adhesive for fiber attachment to ferrule. Connectors shall terminate fiber sizes as required for the service. Station cable faceplates shall be provided and shall be ivory in color, impact resistant plastic with double-sided female ST coupler. Mounting plates shall be provided for system furniture and shall match the furniture system in color.

2.4.3.2 Patch Panels

Patch panels shall be a complete system of components by a single manufacturer, and shall provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross-connection. Patch panels shall be \~ 19 inch~\ rack mounted or \~ 23 inch~\ rack mounted panels as indicated on drawings. Patch panels shall provide strain relief for cables. Panels shall be labeled with alphanumeric x-y coordinates. Patch panel connectors and couplers shall be the same type and configuration as used elsewhere in the system.

2.4.3.3 Patch Cords

Patch cords shall be cable assemblies consisting of flexible optical fiber cable with connectors of the same type as used elsewhere in the system. Optical fiber shall be the same type as used elsewhere in the system. Patch cords shall be complete assemblies from manufacturer's standard product lines.

2.5 EQUIPMENT RACKS

2.5.1 Floor Mounted Open Frame

Floor mounted equipment racks shall be welded steel relay racks with uprights to mount equipment \~ 19 inches~\ wide. Uprights shall be\~ 3 inch~\ deep channel,\~ 1-1/4 inches~\ wide, drilled and tapped 12-24 in a\~ 1/2 inch~\ pattern. Racks shall be provided with a standard top crossmember, and predrilled base plate to allow floor fastening. Open frame equipment racks shall be\~ 7 feet~\ in height and clear coated or painted. AC outlets shall be provided as shown.

2.5.2 Cable Guides

Cable guides shall be specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on \~ 19 inch~\ or \~23 inch~\ equipment racks as indicated on drawings. Cable guides shall consist of ring or bracket-like devices mounted on rack panels for horizontal use or individually mounted for vertical use. Cable guides shall mount to racks by screws and/or nuts and lockwashers.

2.6 EQUIPMENT MOUNTING BACKBOARD

Plywood backboards shall be provided, sized as shown, painted with white or light colored paint.

2.7 TELECOMMUNICATIONS OUTLET BOXES

Electrical boxes for telecommunication outlets shall be\~ 4-11/16 inch~\ square by\~ 2-1/8 inches~\ deep with minimum\~ 3/8 inch~\ deep single or two gang plaster ring as shown. Provide a minimum\~ 1 inch~\ conduit. Floor outlets shall be as shown on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

System components and appurtenances shall be installed in accordance with \-NFPA 70-\, manufacturer's instructions and as shown. Necessary

operable signal distribution system shall be provided. Components shall be labeled in accordance with \-EIA ANSI/TIA/EIA-606-\. Penetrations in

\=07270=\ FIRESTOPPING. Conduits, outlets and raceways shall be installed in accordance with Section \=16415=\ ELECTRICAL WORK, INTERIOR. Wiring shall be

Section \=16415=\ ELECTRICAL WORK, INTERIOR. Wiring, and terminal blocks and outlets shall be marked in accordance with \-EIA ANSI/TIA/EIA-606-\. Cables

floor trench compartment with ac power cables. Cables not installed in conduit or wireways shall be properly secured and neat in appearance and, if

with \-NFPA 70-\ requirements for this type of installation.

3.1.1 Horizontal Distribution Cable

stressed such that twisting, stretching or kinking occurs. Cable shall not be spliced. Fiber optic cables shall be installed either in conduit or through

wireway shall be suspended a minimum of\~ 8 inches~\ above ceilings by cable supports no greater than\~ 60 inches~\ apart. Cable shall not be run through

damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of\~ 12 inches~\ shall be

no cable shall contain unterminated elements. Minimum bending radius shall not be exceeded during installation or once installed. Cable ties shall not

cable are altered. In raised floor areas, cable shall be installed after the flooring system has been installed. Cable\~ 6 feet~\ long shall be neatly

floor areas.

3.1.2 Telecommunications Outlets

As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.

Unshielded twisted pair and fiber optic cables shall have a minimum of\~ 6 inches~\ of slack cable loosely coiled into the telecommunications outlet

exceeded.

3.1.2.3 Pull Cords

outlets which do not initially have fiber optic cable installed.

3.1.3 Terminal Blocks

Terminal blocks shall be mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Industry standard wire routing guides shall be utilized.

3.1.4 Unshielded Twisted Pair Patch Panels

Patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant plus 10 percent spares. Cable guides shall be provided above, below and between each panel.

3.1.5 Fiber Optic Patch Panels

Patch panels shall be mounted in equipment racks with sufficient ports to accommodate the installed cable plant plus 10 percent spares. A slack loop of fiber shall be provided within each panel. Loop shall be \~ 3 feet~\ in length.. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

3.1.6 Equipment Racks

Open frame equipment racks shall be bolted to the floor. Cable guides shall be bolted or screwed to racks. Racks shall be installed level. Ganged racks shall be bolted together. Ganged rack cabinets shall have adjacent side panels removed. Wall mounted racks shall be secured to the mounting surface to prevent fully loaded racks from separating from the mounting surface.

3.1.7 Rack Mounted Equipment

Equipment to be rack mounted shall be securely fastened to racks by means of the manufacturer's recommended fasteners.

3.2 TERMINATION

Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles. Manufacturer's minimum bending radius shall not be exceeded. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.

3.2.1 Unshielded Twisted Pair Cable

Each pair shall be terminated on appropriate outlets, terminal blocks or patch panels. No cable shall be unterminated or contain unterminated elements. Pairs shall remain twisted together to within the proper distance from the termination as specified in \-EIA ANSI/TIA/EIA-568-A-\. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

3.2.2 Fiber Optic Cable

Each fiber shall have connectors installed. The pull strength between the connector and the attached fiber shall be not less than\~ 25 pounds.~\ The mated pair loss, without rotational optimization, shall not exceed 1.0 dB. Fiber optic connectors shall be installed per \-EIA ANSI/TIA/EIA-568-A-\.

3.3 GROUNDING

Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunications closet in accordance with \-EIA ANSI/TIA/EIA-607-\ and Section \=16415=\ ELECTRICAL WORK, INTERIOR. Equipment racks shall be connected to the electrical safety ground.

3.4 ADDITIONAL MATERIALS

The Contractor shall provide the following additional materials required for facility startup.

a. 10 of each type outlet.

b. 10 of each type cover plate.

c. 1 of each type terminal block for each telecommunications closet.

d. 1 Set of any and all special tools required to establish a cross connect and to change and/or maintain a terminal block.

3.5 ADMINISTRATION AND LABELING

3.5.1 Labeling

3.5.1.1 Labels

All labels shall be in accordance with \-EIA ANSI/TIA/EIA-606-\.

3.5.1.2 Cable

All cables will be labeled using color labels on both ends with encoded or unencoded identifiers per \-EIA ANSI/TIA/EIA-606-\.

3.5.1.3 Termination Hardware

All workstation outlets and patch panel connections will be labeled using color coded labels with encoded or unencoded identifiers per \-EIA ANSI/TIA/EIA-606-\.

3.6 TESTING

Materials and documentation to be furnished under this specification are subject to inspections and tests. All components shall be terminated prior to testing. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

3.6.1 Unshielded Twisted Pair Tests

All metallic cable pairs shall be tested for proper identification and continuity. All opens, shorts, crosses, grounds, and reversals shall be corrected. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet. Horizontal wiring shall be tested from and including the termination device in the

communications closet to and including the modular jack in each room. Backbone wiring shall be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective communications closets. These test shall be completed and all errors corrected before any other tests are started.

3.6.2 Category 5 Circuits

All category 5 circuits shall be tested using a test set that meets the Class II accuracy requirements of \-EIA TSB 67-\ standard. Testing shall use the Basic Link Test procedure of \-EIA TSB 67-\. Cables which contain failed circuits shall be replaced and retested to verify the standard is met.

3.6.3 Fiber Optic Cable

Unless stated otherwise, tests shall be performed from both ends of each circuit. Connectors shall be visually inspected for scratches, pits or chips and shall be reterminated if any of these conditions exist. Each circuit leg and complete circuit shall be tested for insertion loss at 850 and 1300 nm using a light source similar to that used for the intended communications equipment. High-resolution optical time domain reflectometer (OTDR) tests shall be performed from one end of each fiber. Scale of the OTDR trace shall be such that the entire circuit appears over a minimum of 80 percent of the X-axis.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 16711

TELEPHONE SYSTEM, OUTSIDE PLANT

05/98

PART
1 - GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI C62.61-\	(1993) Gas Tube Surge Arrestors on Wire Line Telephone Circuits

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM D 2239-\	(1996a) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

\-EIA ANSI/EIA-455-81A-\	(1992) FOTP-81 Compound Flow (Drip) Test for Filled Fiber Optic Cable
\-EIA ANSI/EIA/TIA-455-30B-\	(1991) FOTP-30 Frequency Domain Measurement of Multimode Optical Fiber
\-EIA ANSI/EIA/TIA-455-53A-\	(1990) FOTP-53 Attenuation by Substitution Measurement for Multimode Graded-Index Optical Fibers or Fiber Assemblies Used in Long Length Communications Systems
\-EIA ANSI/EIA/TIA-455-78A-\	(1990; R 1995) FOTP-78 Spectual Attenuation Cutback Measurement for Single Mode Optical Fibers
\-EIA ANSI/TIA/EIA-568A-\	(1995) Commercial Building Telecommunications Cabling Standard
\-EIA ANSI/TIA/EIA-607-\	(1994) Commercial Building Grounding and Bonding Requirements for Telecommunications

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

\-IEEE C2-\	(1997) National Electrical Safety Code

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

\-ICEA ANSI/ICEA S-85-625-\	(1996) Airecore, Polyolefin Insulated, Copper Conductor Telecommunications Cable

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 70-	**(1996; Errata 96-4) National Electrical Code**

RURAL UTILITIES SERVICE (RUS)

\-RUS Bulletin 1753F-401 (PC-2)-	**(1995) RUS Standard for Splicing Copper and Fiber Optic Cables**
\-RUS Bulletin 1755.910-	**RUS Specification for Outside Plant Housings and Serving Area Interface Systems**
\-RUS REA Bulletin 345-39-	**(1985) REA Specification for Telephone Station Protectors (PE-42)**
\-RUS REA Bulletin 345-72-	**(1985) REA Specification for Filled Splice Closures (PE-74)**
\-RUS REA Bulletin 345-90-	**(1986) Totally Filled Fiber Optic Cable (PE-90)**
\-RUS REA Bulletin 345-151-	**(1989) Specifications and Drawings for Conduit and Manhole Construction (Form 515c)**
\-RUS REA Bulletin 1751F-641-	**(1995) Construction of Buried Plant**
\-RUS REA Bulletin 1755I-100-	**(1991; Rev through Supple 11 Nov 92) List of Materials Acceptable for Use on Telephone System of REA Telephone Borrowers**
\-RUS REA PC-4-	**(1976) Acceptance Tests and Measurements of Telephone Plant**
\-RUS REA PE-33-	**(1985) Shield Bonding Connectors**
\-RUS REA PE-39-	**(1993) REA Specification for Filled Telephone Cables**
\-RUS REA PE-60-	**(1979) Trunk Carrier Systems**
\-RUS REA PE-87-	**(1994) Terminating (TIP) Cable**
\-RUS REA PE-89-	**(1993) Filled Telephone Cables with Expanded Insulation**
\-RUS REA TE&CM 635-03-	**(1988; Addenda 1 through 4) Construction of Aerial Cable Plant**

\-RUS REA TE&CM 643-02- **(1983) Underground Conduit and Manhole Design and Construction (Physical Plant)**

UNDERWRITERS LABORATORIES (UL)

\-UL 50- **(1995; Rev thru Oct 1997) Enclosures for Electrical Equipment**

1.2 SYSTEM DESCRIPTION

The outside plant system shall consist of all cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, terminating cables, lightning and surge protection modules at the entry facility. The work consists of furnishing, installing, testing and making operational a complete outside plant system for continuous use.

1.3 *QUALIFICATIONS*\

1.3.1 Cable Installers

Installation shall be under the direct supervision of an individual with a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components.

1.3.2 Cable Splicing and Termination

All cable splicers shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

1.3.3 Manufacturers

The cable, equipment, and hardware provided shall be from manufacturers that have a minimum of 3 years experience in producing the types of cable, equipment, and hardware specified.

1.4 SUBMITTALS

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

SD-01 Data\

Spare Parts and Equipment List\; *FIO*\.

A data list of recommended spare parts, tools, and test equipment for each different item of material and equipment specified prior to beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings\

Telephone System\; *FIO*\.

Detail drawings, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, and catalog cuts. Detail drawings shall also contain complete configuration information, wiring diagrams and any other details required to demonstrate that the cable system has been coordinated to support the transmission systems identified in the specifications and drawings. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operations.

Record Drawings\; *GA*\.

Record drawings for the installed wiring system showing the actual location of all cable terminations, splices, routing, and size and type of all cables. The identifier for each termination and cable shall appear on the drawings. The drawings shall include gauge and pair or fiber count for each cable, duct and innerduct arrangement, or conductor assignment of outside plant, and protector and connector block layout at the termination points after installation.

SD-06 Instructions\

Installation\; *GA*\.

Printed copies of the manufacturer's recommendations for the material being installed, prior to installation. Installation of the item will not be allowed to proceed where installation procedures, or any part thereof, are required to be in accordance with those recommendations until the recommendations are received and approved.

SD-08 Statements\

Acceptance Tests\; *GA*\.

Test plans defining all tests required to ensure that the system meets specified requirements. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

Cutover and Records\; *GA*\.

The cutover plan shall provide procedures and schedules for relocation of facility station numbers without interrupting service to any active location.

SD-09 Reports\

Acceptance Tests\; *FIO*\.

Test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis.

SD-13 Certificates\

Telephone System\; *FIO*\.

Proof that the items furnished under this section conform to the specified requirements in FCC, ICEA, REA, RUS, ANSI, ASTM, NFPA, EIA, or UL, where materials and equipment are so specified.

Qualifications\; *GA*\.

The qualifications of the manufacturer, splicer, and installation supervisor as specified.

1.5 DELIVERY AND STORAGE

1.5.1 Cable Requirements-

All cable shall be shipped on reels. The diameter of the drum shall be large enough to prevent damage to the cable during reeling and unreeling. The reels shall be constructed to prevent damage during shipment and handling. The outer end of the cable shall be securely fastened to the reel head to prevent the cable from becoming loose in transit. The inner end of the cable shall project into a slot in the side of the reel, or into a housing on the inner slot of the drum, with sufficient length to make it available for testing. The inner end shall be fastened to prevent the cable from becoming loose during installation. End seals shall be applied to each of the cables to prevent moisture from entering the cable. The reels with cable shall be suitable for outside storage conditions when the temperature ranges from \~minus 40 to plus 148 degrees F,~\ with relative humidity from 0 to 100 percent.

1.5.2 Equipment

All equipment shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants, in accordance with the manufacturer's requirements.

PART 2 - PRODUCTS

2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 2 years prior to bid opening. Each major component of equipment shall have the manufacturer's name and type identified on the equipment. All products supplied shall be specifically designed and manufactured for use with outside plant communications systems. All items of the same class of equipment shall be the products of a single manufacturer.

2.2 CABLE

2.2.1 Copper Conductor Cable

Copper conductor cable shall conform to the following:

2.2.1.1 Underground

Cable shall be manufactured per \-RUS REA PE-39-\ or \-RUS REA PE-89-\. A \~8 mil~\ coated aluminum or \~5 mil~\ copper metallic shield shall be provided.

2.2.1.2 Screened

Screened cable shall comply with \-RUS REA PE-39-\ or \-RUS REA PE-89-\.

2.2.2 Fiber Optic Cable

Reeled fiber optic cable shall be specifically designed for outside use, be filled or loose buffer construction, and conform to \-RUS REA Bulletin 345-90-\.

2.2.2.1 Cable Cores

A central, nonmetallic core member shall be included to serve as a cable core foundation to reduce strain on the fibers, but not to serve as a pulling strength member.

2.2.2.2 Optical Fiber

Single-mode optical fibers shall be Class IV.

2.2.2.3 Shielding or Other Metallic Covering

A copper, copper alloy, or copper and steel laminate metallic covering or shield shall be provided per \-RUS REA Bulletin 345-90-\.

2.2.2.4 Performance Requirements

The fiber optic cable shall comply with the specified mechanical performance requirements while used in buried and underground duct applications where the temperature varies from \~minus 5 to plus 140 degrees F.~\ Optical performance degradation shall be less than 5 percent of the optical performance requirements in the temperature range of \~minus 5 to plus 140 degrees F.~\ The fiber optic cable shall not be damaged in storage where the temperature may vary from \~minus 40 to plus 148 degrees F.~\

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Underground Closure

Underground closures shall conform to \-RUS REA Bulletin 345-72-\. The closure shall be of stainless steel material and be suitable for use in a vault or manhole.

2.3.2 Fiber Optic Closures

2.3.2.1 Fiber Optic Underground

The underground closure shall be suitable to house a splice organizer in a protective housing. An encapsulating compound shall be poured into this enclosure. The closure shall be of stainless steel material and suitable for use in a vault or manhole. The encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure.

2.4 CABLE SPLICES AND ORGANIZERS

2.4.1 Copper Cable Splices

All cables greater than 25 pairs shall be spliced using modular splicing connectors, which accommodate 25 pairs of conductors at a time. The correct connector size shall be used to accommodate the wire gauge of the cable to be spliced. The connectors used shall be listed in \-RUS REA Bulletin 1755I-100-\.

2.4.2 Fiber Optic Cable Splices

Each fiber optic splice shall be physically protected by a splice kit. The kit shall be specially designed for the splice.

2.4.3 Fiber Optic Splice Organizer

The splice organizer shall be suitable for housing fiber optic splices in a neat and orderly fashion. The splice organizer shall allow for a minimum of \~3 feet~\ of fiber for each fiber within the cable to be neatly stored without kinks or twists. The splice organizer shall accommodate individual strain relief for each splice. The splice organizer shall allow for future maintenance or modification, without damage to the cable or splices. All required splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors shall be provided in the organizer kit.

2.5 MANHOLE AND DUCT

All manhole and duct products shall conform to \-RUS REA TE&CM 643-02-\.

2.5.1 New Manholes

New manholes shall be equipped with pulling-in irons, cable racks, and ground rod, and conform to the requirements of \-RUS REA Bulletin 345-151-\. Manholes shall be a minimum of \~12 feet long by 6 feet wide by 6.5 feet high~\. Manholes shall be designed so that the main trunk conduits enter and exit near the center of the ends, and lateral conduits exit on the sides near the corners. Manholes may be pre-cast or cast in place.

2.5.2 Manhole Overbuilds

Existing manholes which are enlarged as part of this project shall be equipped with new pulling-in irons, cable racks, and ground rod.

2.5.3 Duct/Conduit

Conduit shall be furnished as specified in Sections \=16415=\ ELECTRICAL WORK, INTERIOR and \=16375=\ ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND and as shown on project drawings.

2.5.4 Innerduct

Innerduct shall be SIDR 11.5 polyethylene plastic pipe conforming to \-ASTM D 2239-\.

2.6 MISCELLANEOUS ITEMS

2.6.1 Shield Connectors

Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar, or wire. The connector shall be made of tin-plated tempered brass. Shield bond connectors shall comply with \-RUS REA PE-33-\.

2.6.2 Grounding Braid

Grounding braid shall provide low electrical impedance connections for dependable shield bonding. The braid shall be made from flat tin-plated copper.

2.6.3 Warning Tape

Marking and locating tape shall be acid and alkali resistant polyethylene film, \~6 inches~\ wide with a minimum strength of \~1750 psi~\ lengthwise and \~1500 psi~\ crosswise. The tape shall be manufactured with integral wires, foil backing, or other means to enable detection by a metal detector when the tape is buried up to \~3 feet~\ deep. The metallic core shall be encased in a protective jacket or provided with other means to protect it from corrosion and shall be specifically manufactured for marking and locating underground utilities. The warning tape shall be orange in color and continuously imprinted with the words "WARNING - COMMUNICATIONS CABLE BELOW" at not more than \~48 inch~\ intervals.

PART 3 - EXECUTION

3.1 *INSTALLATION*\

All system components and appurtenances shall be installed in accordance with the manufacturer's instructions and as shown. All installation work shall be done in accordance with the safety requirements set forth in the general requirements of \-IEEE C2-\ and \-NFPA 70-\.

3.1.1 Cable Inspection and Repair

All cable and wire used in the construction of the project shall be handled with care. Each reel shall be inspected for cuts, nicks or other damage. All damage shall be repaired to the satisfaction of the Contracting Officer. The reel wrap shall remain intact on the reel until the cable or wire is ready to be placed.

3.1.1.1 Telephone Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter.

3.1.1.2 Penetrations

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. Where conduits and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in Section \=07270=\ FIRESTOPPING. Fire stopped

penetrations shall not compromise the fire rating of the walls or floors. All underground building entries shall be through waterproof facilities.

3.1.1.3 Cable Protection

Unless otherwise shown or specified, direct buried cable shall be protected in accordance with Table 300.5 of \-NFPA 70-\. Where additional protection is required, cable may be placed in galvanized iron pipe (GIP) sized on a maximum fill of 40% of cross-sectional area, or in concrete encased \~4 inch~\ PVC pipe. Conduits shall extend at least \~6 inches per 12 inches~\ burial depth beyond the edge of the surface where cable protection is required; all conduits shall be sealed on each end. Conduit may be installed by jacking or trenching. Trenches shall be backfilled with earth and mechanically tamped at \~6 inch~\ lifts so that the earth is restored to the same density, grade and vegetation as adjacent undisturbed material.

3.1.2 Underground Cable

Underground cable installation shall be accomplished in accordance with the requirements set forth in \-RUS REA Bulletin 1751F-641-\.

3.1.2.1 Cable Pulling

For cable installed in ducts and conduit, a cable feeder guide shall be used, between the cable reel and the face of the duct and conduit, to protect the cable and guide it into the duct and conduit as it is paid off the reel. As the cable is paid off the reel, it shall be inspected for jacket defects. Precautions shall be taken during installation to prevent the cable from being kinked or crushed. A pulling eye shall be attached to the cable and used to pull the cable through the duct and conduit system. Cable shall be hand fed and guided through each manhole. As the cable is paid off the reel into the cable feeder guide, it shall be sufficiently lubricated with a type of lubricant recommended by the cable manufacturer. Where the cable is pulled through a manhole, additional lubricant shall be applied at all intermediate manholes. Dynamometers or load-tension instruments shall be used to ensure that the pulling line tension does not exceed the installation tension value specified by the cable manufacturer. The mechanical stress placed upon a cable during installation shall not cause the cable to be twisted or stretched.

3.1.2.2 Penetrations for Cable Access

Penetrations in walls, ceilings or other parts of the building, made to provide for cable access, shall be caulked and sealed. Where conduits and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in section \=07270=\ FIRE STOPPING. Fire stopped penetrations shall not compromise the fire rating of the walls or floors. All underground building entries shall be through waterproof facilities.

3.1.2.3 Cable Bends

Telephone cable bends shall have a radius of not less than 10 times the cable diameter. Only large radius sweeps shall be used in conduit runs and shall not exceed a cumulative 90 degrees between manholes.

3.1.3 Manhole and Ducts

Manhole and duct systems shall be installed in accordance with Section \=16375=\ ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Manholes shall be placed in line with the main duct. Splice cases shall be mounted in the center on the long sides. Lateral conduits shall exit the long sides near the corners.

3.1.3.1 Innerduct Installation

Innerduct shall be pulled through existing duct-manhole system in continuous sections. Splices, joints, couplings, or connections of any type will not be allowed between manholes. Innerduct shall be plugged at both ends with polyurethane foam duct seal; this material shall also be inserted between the innerduct and the duct if cables are placed in the innerducts. Only one cable shall be installed in a given innerduct. Existing and new unoccupied innerducts shall be trimmed leaving \~2 inches~\ exposed.

3.1.3.2 Pull Cord

Pull cords of \~3/8 inch~\ polypropylene shall be installed in all unused ducts and inner-ducts with a minimum of \~2 feet~\ spare cord protruding from each end.

3.1.4 Surge Protection

Except for fiber optic cable, all cables and conductors, which serve as communication lines, shall have surge protection meeting the requirements of \-RUS REA PE-60-\ installed at the entry facility.

3.2 SPLICING

3.2.1 Copper Conductor Splices

Copper conductor cable splicing shall be accomplished in accordance with \-RUS Bulletin 1753F-401(PC-2)-\. Modular splicing shall be used on all cables larger than 25 pairs.

3.2.2 Fiber Optic Splices

Fiber optic splicing shall be in accordance with the manufacturer's recommendation; each splice shall have a loss of less than 0.1 dB.

3.3 GROUNDING

Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals shall be grounded. Grounding shall be in accordance with requirements of \-NFPA 70-\, Articles 800-33 and 800-40.

3.4 *CUTOVER AND RECORDS*\

All necessary transfers and cutovers, shall be accomplished by the Contractor.

3.5 \+*ACCEPTANCE TESTS*\+\

The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test; testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. The test plans shall define all the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested.

3.5.1 \+Copper Conductor Cable+

The following acceptance tests shall be performed in accordance with \-RUS REA PC-4-\:

a. Shield continuity.

b. Conductor continuity.

c. Conductor insulation resistance.

d. Structural return loss.

e. Cable insertion loss and loss margin at carrier frequencies.

f. Shield ground for single jacketed cables.

g. DC loop resistance.

3.5.2 \+Fiber Optic Cable+

Two optical tests shall be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. In addition, a Bandwidth Test shall be performed on all multi-mode optical fibers. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly.

3.5.2.1 \+OTDR Test+

The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings, improper splices, for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, \~3280 feet~\minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. The OTDR test shall be conducted in accordance with \-EIA ANSI/EIA-455-81A-\ for single-mode fiber and \-EIA ANSI/EIA/TIA-455-78A-\ for multi-mode fiber. Splice losses shall not exceed 0.1db. Attenuation losses shall not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber. Attenuation losses shall not exceed 5.0 db/km at 850 nm and 1.5 db/km at 1300 nm for multi-mode fiber.

[AM#1]
3.5.2.2 \+Attenuation Test+

End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 850 nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met. The measurement method shall be in accordance with \-EIA ANSI/EIA/TIA-455-53A-\.

3.5.2.3 \+Bandwidth Test+

The end-to-end bandwidth of all multi-mode fiber span links shall be measured by the frequency domain method. The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with \-EIA ANSI/EIA/TIA-455-30B-\.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 16721

FIRE DETECTION AND ALARM SYSTEM

11/91

PART
1 - GENERAL

[AM#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 NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI C135.30-\	(1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

CODE OF FEDERAL REGULATIONS

\-47 CFR 15-\	Radio Frequency Devices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

\-FM P7825-\	(1994; Supple 1) Approval Guide

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

\-IEEE C62.41-\	(1991) Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 70-\	(1996) National Electrical Code
\-NFPA 72-\	(1996) National Fire Alarm Code
\-NFPA 90A-\	(1993) Installation of Air Conditioning and Ventilating Systems
\-NFPA 1221-\	(1994) Installation, Maintenance and Use of Public Fire Service Communication Systems

UNDERWRITERS LABORATORIES (UL)

\-UL-04-\	(1994) Fire Protection Equipment Directory
\-UL 6-\	(1993) Rigid Metal Conduit

\-UL 38-\	(1994; Rev Jan 1994) Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems
\-UL 228-\	(1993) Door Closers-Holders, with or without Integral Smoke Detectors
\-UL 268-	**(1989; Rev May 1989) Smoke Detectors for Fire Protective Signaling Systems**
\-UL 464-\	(1990) Audible Signal Appliances
\-UL 467-\	(1993) Grounding and Bonding Equipment
\-UL 521-\	(1993) Heat Detectors for Fire Protective Signaling Systems
\-UL 797-\	(1993) Electrical Metallic Tubing
\-UL 864-\	(1991; Rev thru May 1994) Control Units for Fire-Protective Signaling Systems
\-UL 1242-\	(1983; Rev thru Jul 1993) Intermediate Metal Conduit

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours.

1.2.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.2.3 Keys and Locks

Locks shall be keyed alike and type CAT-15.

1.2.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

1.2.5 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.2.6 Compliance

The fire detection and internal alarm system and the central reporting system shall be configured in accordance with \-NFPA 72-\. The equipment furnished shall be compatible and be UL listed or FM approved or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

1.2.7 Manufacturer's Services

Services of a manufacturer's representative who is experienced in the installation, adjustment, testing, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.3 SYSTEM DESIGN

1.3.1 Operation

The fire alarm and detection system shall be a complete, supervised addressable fire alarm system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected to signal line circuits (SLC), Style 6, in accordance with \-NFPA 72-\. Alarm notification appliances shall be connected to notification appliance circuits (NAC), Style Z in accordance with \-NFPA 72-\. A loop conduit system shall be provided so that if any one conduit and all conductors contained in that conduit are severed all NAC, or SLC on that circuit shall remain functional. A loop system is not applicable to the central fire alarm communication center from the local panels. All textual, audible, and visual appliances and systems shall comply with \-NFPA 72-\.

Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits.

a. Sufficient memory shall be provided to perform as specified and as shown for addressable system.

b. Individual identity of each addressable device shall be provided for the following conditions:

alarm
trouble
open
short
appliances missing/failed
remote detector - sensitivity adjustment from the panel for smoke detectors

c. All addressable devices shall have the capability of individually being disabled or enabled from the panel.

1.3.2 Operational Features

The system shall have the following operating features:

a. Electrical supervision of alarm SLC and NAC. Smoke detectors shall have combined alarm initiating and power circuits.

b. Electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.

c. Trouble buzzer and trouble lamp (light emitting diode or neon light) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator lamp. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

d. Transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but shall provide a trouble signal when disconnected and a restoration signal when reconnected. One person test mode - Activating an initiating device in this mode will activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.

e. Evacuation alarm silencing switch or switches which, when activated, will silence alarm devices, but will not affect the zone indicating lamp nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed zone and the alarm devices will be activated.

f. Electrical supervision of circuits used for supervisory signal services. Supervision shall detect any open, short, or ground.

g. Confirmation or verification modules used on smoke detection initiating circuits. The modules shall interrupt the transmission of an alarm signal to the system control panel for a factory set period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal if present will be sent immediately to the control panel. All fire alarm devices other than smoke detectors shall be prohibited on circuits controlled by confirmation or verification modules.

h. Zones for alarm SLC shall be arranged as indicated on the contract drawings.

[AM#1]
1.3.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following functions:

a. <u>Transmission of signals over the station radio fire reporting system. Nomenclature for each zone shall be reported for trouble and alarm</u>

signals through the transmitter and shall be identical to the zones shown on the electrical drawings.

b. Visual indications of the alarmed zones on the fire alarm control panel annunciator .

c. Continuous sounding of alarm notification appliances throughout the building.

d. Closure of doors held open by electromagnetic devices.

e. Deactivation of the air handling units throughout the building.

1.3.4 Primary Power

Operating power shall be provided as required by paragraph Power Supply for the System. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.3.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FI0" designation are for information only. The following shall be submitted in accordance with Section \=01330=\ SUBMITTAL PROCEDURES:

SD-01 Data\

Battery\; *FIO*\.

Substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component, and the battery recharging period shall be included.

Voltage Drop\; *FIO*\.

Voltage drop calculations for signaling appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

Spare Parts\; *FIO*\.

Spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.

Qualifications\; *FIO*\.

Qualifications, with verification of experience and license number, of a Registered Professional Engineer with at least 4 years of current experience in the design of the fire protection and detection systems. This engineer must perform the various specification items required by this section to be performed by a registered Professional Engineer.

SD-04 Drawings\

Fire Alarm Reporting System\; *FIO*\.

Detail drawings, signed by the Registered Professional Engineer, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Note that the contract drawings show layouts based on typical detectors. The contractor shall check the layout based on the actual detectors to be installed and make any necessary revisions in the detail drawings. The detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.

Detailed point-to-point wiring diagram, signed by the Registered Professional Engineer, showing all points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and all equipment that is activated or controlled by the panel.

SD-06 Instructions\

Fire Alarm Reporting System\; *GA*\.

Six copies of operating instructions outlining step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The instructions shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed. Instructions shall be approved prior to training.

Training\; *FIO*\.

Lesson plans and training data, in manual format, for the training courses.

SD-08 Statements\

Test Procedures\; *GA*\.

Detailed test procedures, signed by the Registered Professional Engineer, for the fire detection and alarm system 60 days prior to performing system tests.

SD-09 Reports\

Testing\; *FIO*\.

Test reports in booklet form showing all field tests performed to prove compliance with the specified performance criteria, upon completion and

testing of the installed system. Each test report shall document all readings, test results and indicate the final position of controls.

SD-13 Certificates\

Equipment\; *FIO*\.

Certified copies of current approvals or listings issued by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Installer\; *FIO*\.

The Contractor shall provide documentation demonstrating that its fire detection and alarm system installer has been regularly engaged in the installation of fire detection and alarm systems meeting NFPA standards for a minimum of three years immediately preceding commencement of this contract. Such documentation shall specifically include proof of satisfactory performance on at least three projects similar to that required by these specifications, including the names and telephone numbers of using agency points of contact for each of these projects. Documentation shall indicate the type of each system installed and include a written certificate that each system has performed satisfactorily in the manner specified for a period of not less than 12 months following completion. All such data shall be submitted 30 days prior to commencement of installation for approval of the Contracting Officer. Listing of the installer under "Protective Signaling Services - Local, Auxiliary, Remote Station Proprietary (UUJS)" of \-UL-04-\ shall be accepted as equivalent proof of compliance with the foregoing experience requirements.

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, and any other contaminants.

PART 2 - PRODUCTS

[AM#1]
2.1 CONTROL PANEL

Control Panel shall comply with all the applicable requirements of \-UL 864-\. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing all components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for all LED/LCDs, zones, SLC, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. The LED/LCD displays shall be located on exterior of cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means shall be provided for testing the control panel visual indicating devices (meters or LEDs/LCDs). Meters and LEDs shall be plainly visible when the cabinet door is closed. Signals and LEDs/LCDs shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Each SLC initiating circuit shall be powered and supervised so that a signal

on one zone does not prevent the receipt of signals from other zones. Loss of power, including batteries, shall not require the manual reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals. Visual annunciation shall be provided for LED/LCD visual display and shall be provided as an integral part of the control panel and shall identify with a word description and id number for each device. The control panel shall be capable of handling a minimum of 150 initiating devices and 120 notification devices.

2.1.1 \&Visual Annunciators&

Visual annunciators shall be provided for each active zone and spare zone. 6 Spare zones shall be provided. Each lamp shall provide specific identification of the zone by means of a permanently attached rigid plastic, phenolic or metal sign with either raised or engraved letters. Zone identification shall consist of word description of the zone.

2.1.2 \&Cabinets&

Cabinets shall be provided with ample gutter space to allow proper clearance between the cabinet and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single cabinet large enough to accommodate all units. \&Cabinets shall be painted red&\

2.1.3 Remote System Trouble Audible/Visual Appliance

Audible appliance shall have a minimum sound level output rating of 85 dBA at\~ 10 feet~\ and operate in conjunction with the panel's integral trouble signal. The audible device shall be silenced by the system trouble silence switch. A rigid plastic, phenolic or metal identification sign which reads "Fire Alarm System Trouble" shall be provided at the audible appliance. The visual appliance located with the audible appliance shall not be extinguished until the trouble has been cleared.

2.1.4 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each terminal marked for identification.

2.2 ADDRESSABLE CONTROL MODULE

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems and initiate elevator fire service. The module shall be UL listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Style Y notifcation appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. The control module shall provide address setting means compatible with the control panel’s SLC supervision and store an internal identifying code. The control module shall contain an intergral LED that flashes each time the contol module is polled.

2.3 ADDRESSABLE INITIATING DEVICE CIRCUITS MODULE

The initiating device being monitored shall be configured as a Style D initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling. The module shall be UL listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

2.4 TRANSMITTERS

[AM#1]

2.4.1 Radio Alarm Transmitters

Transmitters shall be compatible with proprietary supervising station receiving equipment. Each radio alarm transmitter shall be the manufacturer's recognized commercial product, completely assembled, wired, factory tested, and delivered ready for installation and operation. Transmitter shall be provided in accordance with applicable portions of \-NFPA 72-\, \-NFPA 1221-\, and \-47 CFR 15-\. Transmitter electronics module shall be contained within the physical housing as an integral, removable assembly. The proprietary supervising station receiving equipment is Monaco D500 Plus operating at a frequency of 139.675 MHz. The transceiver shall be fully compatible with this equipment. At the contractors option and if UL listed, the transmitter may be housed in the same panel as the fire alarm control panel. <u>The transmitter shall be capable of transmitting all zones shown on the electrical drawings and 6 spare zones for future use.</u>

2.4.1.1 Transmitter Power Supply

Each radio alarm transmitter shall be powered by a combination of locally available 120-volt ac power and a lead-calcium battery.

a. Operation: Each transmitter shall operate from 120-volt ac power. In the event of 120-volt ac power loss, the transmitter shall automatically switch to battery operation. Switchover shall be accomplished with no interruption of protective service, and shall automatically tranmit a trouble message. Upon restoration of ac power, transfer back to normal ac power supply shall be automatic.

b. Battery Power: Transmitter standby battery capacity shall provide sufficient power to operate the transmitter in a normal standby status for a minimum of 48 hours and be capable of transmitting alarms during that period.

2.4.1.2 Radio Alarm Transmitter Housing

Tranmitter housing shall be NEMA Type 1. The housing shall contain a lock that is keyed identical to the fire alarm system for the building. Radio alarm transmitter housing shall be factory painted with a suitable priming coat and not less than two coats of a hard, durable weatherproof enamel.

2.4.1.3 Antenna

The Contractor shall provide omnidirectional, coaxial, halfwave dipole antennas for radio alarm transmitters with a driving point impedance to match transmitter output. The antenna and antenna mounts shall be corrosion resistant and designed to withstand wind velocities of 100 mph. Antennas shall not be mounted to any portion of the building roofing system.

2.5 STORAGE BATTERIES

Storage Batteries shall be provided and shall be the sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 48 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 15minutes. Batteries shall be sized to deliver 50 percent more ampere/hours based on a 48 hour discharged rate than required for the calculated capacities. Battery cabinet shall be a separate compartment within the control panel. Batteries in the control panel shall be located at the bottom of the panel. Battery shall be provided with overcurrent protection in accordance with \-NFPA 72-\.

2.6 BATTERY CHARGER

Battery charger shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 12 hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly if a high rate switch is provided. Charger shall be located in control panel or battery cabinet.

2.7 MANUAL FIRE ALARM STATIONS

Manual fire alarm stations shall conform to the applicable requirements of \-UL 38-\. Manual stations shall be addressable and connected into signal line circuits. Stations shall be installed on semi-flush mounted outlet boxes. Stations shall be double action type. Stations shall be finished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable. Stations employing glass rods are not acceptable. The use of a key shall be required to reset the station. Key for the manual fire alarm station shall be CAT-15. The use of a wrench or any device other than the CAT-15 key shall not be allowed. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be painted the same color as the fire alarm manual stations. Addressable pull stations shall be capable of being field programmed, shall latch upon operation and remain latched until manually reset.

2.8 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of \-NFPA 72-\, \-NFPA 90A-\, \-UL 268-\, and \-UL 521-\. The detectors shall be

provided as indicated. Detector base shall have screw terminals for making connections. No solder connections will be allowed. Detectors shall be connected into alarm initiating circuits. Detectors located in concealed locations (above ceiling, etc.) shall have a remote visible indicator lamp. Installed devices shall conform to the classification of the area. All initiating devices shall be addressable and shall be dynamically supervised and uniquely identified in the control panel.

2.8.1 Smoke Detectors

Detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be ionization type. Detectors shall contain a visible indicator LED/LCD that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making all wiring connections. Detectors that are in concealed (above false ceilings, etc.) locations shall have a remote visible indicator LED/LCD suitable for mounting in a finished, visible location.

2.8.1.1 Ionization Detectors

Ionization detectors with a dual chamber shall be responsive to both invisible and visible particles of combustion. One chamber shall be a reference chamber and the second a sampling chamber. Detectors containing radium shall not be provided. Detectors shall not cause an alarm condition due to anticipated fluctuations in relative humidity. The sensitivity of the detector shall be field adjustable to compensate for operating conditions. Detector shall require no replacement or readjustment to restore it to normal operation after an alarm condition. Each detector shall be capable of withstanding ambient air velocity up to\~ 300 fpm~\ in accordance with \-UL 268-\. Detectors shall have at least a two-stage sensitivity setting, with detectors initially set for normal sensitivity. A lower sensitivity shall be available for each detector. The lower sensitivity shall be within the limits established for that detector by UL or FM. Addressable smoke detectors shall be capable of having the sensitivity being remotely adjusted by the control panel.

2.8.1.2 Duct Detectors

Duct detectors are rovided under Section \=15950=\ Heating, Ventilation, and Air Conditioning HVAC Control Systems.

2.8.2 Combination Smoke and Heat Detectors

Combination smoke and heat detectors shall have an audible device (self-contained) and be designed for detection of abnormal smoke densities by the photoelectric principle and abnormal heat by a fixed temperature sensor. Smoke detectors shall be provided with an LED light source. Failure of the LED shall not cause an alarm condition and the sensitivity shall be factory set at a nominal 3 percent and require no field adjustments of any kind. Heat detector portion shall be fixed temperature sensor rated at\~ 135 degrees F.~\ The audible appliances shall have a minimum sound output of at least 85 dBA at\~ 10 feet.~\ Detectors shall contain a visible indicator lamp that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Each detector shall be reverse polarity

whereby, when connected to the signaling appliance circuit, and in the event of a building alarm, the audible device shall sound.

2.8.3 Flame Detectors

The detectors shall comply with \-FM P7825-\. The detectors shall be sensitive to the micron range best suited for their intended use. The detectors shall operate over electrically supervised wiring circuits and the loss of power to the detector shall result in a trouble signal. A self-test feature shall be provided for each detector to be individually tested.

2.9 NOTIFICATION APPLIANCES

Audible appliances shall be heavy duty and conform to the applicable requirements of \-UL 464-\. Devices are not required to be addressable but shall be connected into alarm notification appliance circuits \&and shall have a separate screw terminal for each conductor. Audible appliances shall generate a unique audible sound from other devices rovided in the building and surrounding area. Devices shall be painted red. &\

2.9.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box recessed single projector, grill and vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a sound rating of at least 85 dBA at\~ 10 feet.~\ Horns used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grills.

2.9.2 Visual Notification Appliances

Visual notification appliances shall have high intensity optic lens, xenon flash tubes, and output white light. Strobe flash rate shall be between 1 to 3 flashes per second and a minimum of 75 candela. Strobe shall be semi-flush mounted.

2.9.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. All units shall be factory assembled. Any other audible notification appliance employed in the fire alarm systems shall be approved by the authority having jurisdiction.

2.10 REMOTE ANNUNCIATION EQUIPMENT

2.10.1 Remote System Audible/Visual Display

The reomote system equipment shall have an audible appliance that shall have a minimum sound level output rating of 85 dBA at 10 feet and operate in conjunction with the panel integral display. The audible device shall be silenced by a system silence switch on the remote system. The audible device shall be silenced by the system silence switch located at the remote location, but shall not extinguish the visual indication. The remote LED/LCD visual display shall provide identification, consisting of the word description and id number for each device as displayed on the control panel. A rigid plastic,

phenolic or metal identification sign which reads “Fire Alarm System Remote Display” shall be provided at the remote audible/visual display. The remote visual appliance located with the audible appliance shall not be extinguished until the trouble or alarm has been cleared. Panel door shall have a keyed lock identical to the lock on the control panel. Annunciator shall be surface mounted.

2.11 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.11.1 Ground Rods

Ground rods shall be of zinc-coated steel conforming to \-ANSI C135.30-\ not less than\~ 3/4 inch~\ in diameter by\~ 10 feet~\ in length .

2.11.2 Conduit

Conduit and fittings shall comply with \-UL 6-\, \-UL 1242-\ and \-UL 797-\.

2.11.3 Wiring

Wiring for 120V ac power shall be No. 12 AWG minimum. Wiring for low voltage dc circuits shall be No. 14 AWG minimum. Power wiring (over 28 volts) and control wiring shall be isolated. All wiring shall conform to \-NFPA 70-\. In addition, the system field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except rigid plastic conduit may be used under slab-on-grade. All conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to alarm initiating, supervisory circuits, and alarm notification appkiance circuits are prohibited. T-tapping using screw terminal blocks is allowed for addressable systems.

[AM#1]
2.11.4 Special Tools and Spare Parts

<u>Software, connecting cables, and proprietary equipment, necessary for the maintenance, testing and reprogramming of the equipment shall be furnished to the Contracting Officer.</u> Two spare fuses of each type and size required and five spare lamps and LED's of each type shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Fuses and lamps shall be mounted in the fire alarm panel.

PART 3 - EXECUTION

3.1 INSTALLATION

All work shall be installed as shown and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until the building has been thoroughly cleaned.

3.1.1 Power Supply for the System

A single dedicated circuit connection for supplying power to each building fire alarm system shall be provided. The primary power shall be supplied as

shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.1.2 Wiring

Conduit size for wiring shall be in accordance with \-NFPA 70-\. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. No more than one conductor shall be installed under any screw terminal. All circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors are prohibited in the system. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.1.3 Control Panel

The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than\~ 12 inches~\ nor more than\~ 78 inches~\ above the finished floor. All manually operable controls shall be between\~ 36 inches~\ to\~ 42 inches~\ above the finished floor. Panel shall be installed to comply with the requirements of \-UL 864-\.

3.1.4 Detectors

Detectors shall be installed in accordance with \-NFPA 72-\. Detectors shall be at least\~ 12 inches~\ from any part of any lighting fixture. Detectors shall be located at least\~ 3 feet~\ from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in free space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds\~ 3 feet,~\ sway bracing shall be provided.

3.1.5 Notification Appliances

Notification appliances shall be mounted a minimum of 80 inches above the finished floor Or 6 inches below the ceiling, whichever is lower.

3.1.6 Annunciator Equipment

Annunciator equipment provided shall be mounted where indicated.

3.1.7 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional intiating devices (water flow switches, water pressure switches, high/low air pressure switches, and tamper switches)., The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed on style B lines. Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other

fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions as specified in \=15330=\ WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, \-NFPA 72-\, as indicated on the drawings and stated within this specification.

3.1.8 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. If a supplementary suppression releasing panel is provided, then the monitor modules shall be mounted in a common enclosure adjacent to the suppression releasing panel and both this enclosure and the suppression releasing panel shall be in the same room as the releasing devices. All interconnecting wires shall be supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems such as HVAC or elevator control, then they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, do not require protection subsystems shall be connected to the fire alarm system to perform required alarm functions as specified in \=15330=\WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION, \-NFPA 72-\, as indicated on the drawings and stated within this specification section.

3.2 OVERVOLTAGE AND SURGE PROTECTION

All equipment connected to alternating current circuits shall be protected from surges per \-IEEE C62.41-\ and \-NFPA 70-\. All cables and conductors which serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

3.3 GROUNDING

Grounding shall be provided to building ground or ground rods shall be driven. Maximum impedance to ground shall be 25 ohms. Ground rods shall not protrude more than\~ 6 inches~\ above grade.

3.4 TESTING

The Contractor shall notify the Contracting Officer 30 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise all tests. The Contractor shall furnish all instruments and personnel required for the tests.

3.4.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance. Tests shall include the meggering of all system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the

installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional.

3.4.2 Acceptance Test

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Testing shall be in accordance with \-NFPA 72-\. The recommended tests in \-NFPA 72-\ shall be considered mandatory and shall verify that all previous deficiencies have been corrected. The Contractor shall complete and submit the \-NFPA 72-\, Inspection and Testing Form. The test shall include all reqirements of \-NFPA 72-\ and the following:

a. Test of each function of the control panel.

b. Test of each circuit in both trouble and normal modes.

c. Tests of alarm initiating devices in both normal and trouble conditions.

d. Tests of each control circuit and device.

e. Tests of each alarm notification appliance.

f. Tests of the battery charger and batteries.

g. Complete operational tests under emergency power supply.

h. Visual inspection of all wiring connections.

i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.

j. Ground fault

k. Short circuit faults

l. Stray voltage

m. Loop resistance

3.5 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period shall consist of 3 training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover all of the items contained in the operating and maintenance instructions.

- - o 0 o - -

ACCOMPANYING AMENDMENT NO. 0001 TO SOLICITATION NO. DACA63-98-B-0040

SECTION 16770

RADIO AND PUBLIC ADDRESS SYSTEMS

07/89

PART
1 - GENERAL

[AM#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.

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

\-EIA ANSI/EIA-568-A-\	(1995) Commercial Building Telecommunications Cabling Standard
\-EIA ANSI/EIA/310-D-\	(1992) Cabinets, Racks, Panels, and Associated Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

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

1.2 SYSTEM DESCRIPTION

The radio and public address system shall consist of an audio distribution network to include amplifiers, mixers, microphones, speakers, cabling, and any ancillary components required to meet the required system configuration and operation.

1.2.1 Single Channel System

The system shall control and amplify an audio program for distribution within the areas indicated. Components of the system shall include a mixer-preamplifier,one way amplifier speaker system, cabling, handset system and other associated hardware.

1.2.2 System Performance

The system shall provide even sound distribution throughout the designated area, plus or minus 3 dB for the 1-octave band centered at 4000 Hz. The system shall provide uniform frequency response throughout the designated area, plus or minus 3 dB as measured with 1/3-octave bands of pink noise at locations across the designated area selected by the Contracting Officer. The system shall be capable of delivering 75 dB average program level with

additional 10 dB peaking margin sound pressure level (SPL) to any location in the area at an acoustic distortion level below 5 percent total harmonic distortion (THD). Unless otherwise specified the sound pressure reference level is 20 micro Pascal (0.00002 Newtons per square meter).

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\

Spare Parts\; *FIO*\.

Spare parts data for each different item of material and equipment specified, after approval of the detail drawings and not later than 1 month prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings\

Radio and Public Address System\; *GA*\.

Detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Detail drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-09 Reports\

Test Plan\; *FIO*\.

Test plan and test procedures for the acceptance tests. The test plan and test procedures shall explain in detail, step-by-step actions and expected results to demonstrate compliance with the requirements specified. The procedure shall also explain methods for simulating the necessary conditions of operation to demonstrate system performance.

Acceptance Tests\; *FIO*\.

Test reports in booklet form showing all field tests performed to adjust each component and to prove compliance with the specified performance criteria, upon completion and testing of the installed system. The reports shall include the manufacturer, model number, and serial number of test equipment used in each test. Each report shall indicate the final position of controls and operating mode of the system.

SD-19 Operation and Maintenance Manuals\

Radio and Public Address System\; *FIO*\.

Six copies of the operation manual outlining the step-by-step procedures required for system start up, operation, and shutdown. The manual shall include equipment layout and schematics of simplified wiring and control diagrams of the system as installed, the manufacturer's name, model number, and brief description of all equipment and their basic operating features. Six copies of maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. The manual shall include equipment layout and schematics and simplified wiring and control diagrams of the system.

1.4 DELIVERY AND STORAGE

Equipment placed in storage until installation time shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

1.5 VERIFICATION OF DIMENSIONS

The Contractor shall become familiar with the details of the work and working conditions, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancies before performing the work.

PART 2 - PRODUCTS

2.1 STANDARD PRODUCTS

Material and equipment to be provided shall be the standard products of a manufacturer regularly engaged in the manufacture of such products, and shall essentially duplicate material and equipment that have been in satisfactory use at least 2 years. All components used in the system shall be commercial designs that comply with the requirements specified. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.1 Identical Items

Items of the same classification shall be identical. This requirement includes equipment, modules, assemblies, parts, and components.

2.1.2 Nameplates

Each major component of equipment shall have the manufacturer's name, address, model and catalog number, and serial number on a plate secured to the equipment.

2.2 MIXER-PREAMPLIFIER

The mixer-preamplifier shall provide a minimum of nine page zones of voice announce and an all call. It shall also contain a built in preamplifier for one-way page operation. In addition, the mixer-preamplifier shall as a minimum conform to the following specifications:

Power Requirement:	24 Vdc
Input impedance Tip and Ring:	600 ohms

Tone Signals:	Industry Standards
Frequency Bandwidth:	3%
Detect:	40 ms
Interdigital Time	40ms

2.3 ONE WAY AMPLIFIED SPEAKERS

The one way amplified speakears shall be capable of One Way Page Controls. It shall include a self-contained dual input amplifier and volume control, 8 inch cone type ceiling mounted speaker, operate on -24 VDC & 50 mA and have screw terminals for all connections. The amplifier input imedance shall be 1000 ohms Nominal, the amplifier input level shall be -10dbm Nominal and the amplifier output shall be one watt into 45 ohm speaker load.

2.4 HANDSET SYSTEM

The handset system shall be set up for the Intercom System. The handset shall have the capability of lifting the handset and pressing an appropriate speed dial button (one speed dial button for each zone and one for an all call. The handset shall not be connected to the base telephone system.

[AM#1]
2.5 SPEAKER AND MICROPHONE CABLE

Cables shall meet the requirements of \-EIA ANSI/TIA/EIA-568-A-\ for Category 3 or 5 cable. Cable shall be label-verified. Cable jacket shall be factory marked at regular intervals indicating verifying orgainiziation and performance level. Conductors shall be solid untinned copper 24 AWG. Cable shall be rated CMG per \-NFPA 70-\.

PART 3 - EXECUTION

3.1 INSTALLATION

All equipment shall be installed as indicated and specified, and in accordance with the manufacturer's recommendations except where otherwise indicated. Equipment mounted out-of-doors or subject to inclement conditions shall be weatherproofed.

[AM#1]
3.1.1 Wiring

Twisted pair cables shall have a minimum of 6 inches of slack cable loosely coiled into the speaker units. Minimum manufacturers bend radius for each type of cable shall not be exceeded. Cables shall not bend at right angles and cables shall sweep into the termination area. No cable shall be unterminated or conatin unterminated elements. Pairs shall remain twisted together to within the proper distance from the termination as specified in \-EIA ANSI/TIA/EIA-568-A-\. Conductors shall not be damaged when removing insulation. Wire insulation shall not be damaged when removing outer jacket.

Wiring shall be installed in rigid conduit, intermediate metal conduit, cable trays, or electric metallic tubing as specified in Section \=16415=\ ELECTRICAL WORK, INTERIOR. Wiring for microphone, grounding, line level, video, speaker and power cables shall be isolated from each other by physical isolation and metallical shielding. Shielding shall be terminated at only one end.

3.2 GROUNDING

All grounding practices shall comply with \-NFPA 70-\.

3.3 *ACCEPTANCE TESTS*

After installation has been completed, the Contractor shall conduct acceptance tests, utilizing the approved test procedures, to demonstrate that equipment operates in accordance with specification requirements. The Contractor shall notify the Contracting Officer 3 days prior to the performance of tests. In no case shall notice be given until after the Contractor has received written Contracting Officer approval of the test plans as specified. The acceptance tests shall include originating and receiving messages at specified stations, at proper volume levels, without cross talk or noise from other links or nondesignated units.

3.4 TRAINING

The Contractor shall conduct a training course for members of the operating and maintenance staff as designated by the Contracting Officer. The training course will be given at the installation during normal working hours for a total of 4 hours and shall start after the system is functionally complete but prior to final acceptance tests. The field instructions shall cover all of the items contained in the approved operating and maintenance manuals, as well as demonstrations of routine maintenance operations. The Contracting Officer shall be notified at least 14 days prior to the start of the training course.

- - o 0 o - -