IFB No. DACW09-93-B-0003

US Army Corps
of Engineers
Los Angeles District

HEDGPETH HILLS CULTURAL RESOURCES INTERPRETIVE CENTER

at

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Phoenix, AZ 85009

Maricopa County, Arizona

Construction Solicitation and Specifications

October 1992

A360.502

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
N/A	1 of 46

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
0001	13 Nov 92	N/A	SPEC NO: W93B0003

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than Item 6)	CODE
U.S. ARMY ENGINEER DISTRICT, LOS ANGELES P.O. Box 2711 Los Angeles, California 90053-2325		U.S. ARMY ENGINEER DISTRICT, LOS ANGELES P.O. Box 2711 Los Angeles, California 90053-2325	

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

CODE FACILITY CODE

(X)

9A. AMENDMENT OF SOLICITATION NO.

DACW09-93-B-0003

9B. DATED (SEE ITEM 11)

1 DEC 92

10A. MODIFICATION OF CONTRACT/ORDER NO.

N/A

10B. DATED (SEE ITEM 13)

N/A

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☒ is extended, ☐ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT 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.

(X) 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 AUTHORITY OF:

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.)

HEDGEPETH HILLS CULTURAL RESOURCES INTERPRETIVE CENTER, Maricopa County, Arizona

1. The bid opening date is hereby extended to 1 December 1992.
2. Replace Section 00750, Rates of Wages with enclosure 2
3. Attach enclosure 3 to end of Section 01440, Contractor Quality Control
4. Delete Section 10750, Telephone Enclosures

(Continued on back of sheet)

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

HEDGEPETH HILLS CULTURAL RESOURCES INTERPRETIVE CENTER, Maricopa County, Arizona
4 Encls:

(CONTINUED)

1. Replacement pages: Page 2 of Table of Contents, 008003, 01200-1,-2,-3, 01430-6, 01440-2,-23,-24; TABLE OF CONTENTS (SECTION 02660) (2 Pages); 02660-15,-15a; 03301-5; TABLE OF CONTENTS (SECTION 03450), 03450-4,-4a; TABLE OF CONTENTS (SECTION 05055), 05055-2, 09680-5; TABLE OF CONTENTS (SECTION 16415) (2 Pages), 16415-1,-2, -3,-5,-11; 16721-9, and 16752-7.

2. Rates of Wages (6 Sheets)

3. Sample Forms (9 Sheets)

4. Dwg. No. (Dist. File No.): 252/1100, 252/1101, 252/1103, 252/1104, 252/1106, 252/1107, 252/1108, 252/1109, 252/1110, 252/1111, 252/1112, 252/1113, 252/1114, 252/1115, 252/1116, 252/1117, 252/1118, 252/1119, 252/1120, 252/1121, 252/1122, 252/1123, 252/1127, 252/1128, 252/1131, 252/1132, 252/1134, 252/1135, 252/1146, 252/1147, 252/1149, 252/1150 and 252/1151 (all Rev. "A").

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(c) Promptly upon completing a survey, the Contractor shall furnish the originals of all field notes and all other records relating to the survey or to the layout of the work to the Contracting Officer, who shall use them as necessary to determine the amount of progress payments. The Contractor shall retain copies of all such material furnished to the Contracting Officer.

7. EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (1989 JUL) EFARS 31.105.

(a) 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 when the Government can determine both ownership and operating costs for each piece of equipment or equipment groups of similar serial and series from the Contractor's accounting records. When both ownership and operating costs cannot be determined from the Contractor's accounting records, equipment costs shall be based upon the applicable provisions of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule," Region VII. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retrospective pricing, the schedule in effect at the time the work was performed shall apply. For retrospective pricing, the schedule in effect at the time the work was performed shall apply.
(b) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36 substantiated by certified copies of paid invoices. Rates for equipment rented from an organization under common control, lease-purchase or sale-leaseback arrangements will be determined using the schedule except that rental costs leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees are allowable. Costs for major repairs and overhaul are unallowable.
(c) When actual equipment costs are proposed and the total amount of the pricing action is over $25,000, cost or pricing data shall be submitted on Standard Form 1411, "Contract Pricing Proposal Cover Sheet." By submitting cost or pricing data, the Contractor grants to the Contracting Officer or an authorizing representative the right to examine those books, records, documents and other supporting data that will permit evaluation of the proposed equipment costs. After price agreement the Contractor shall certify that the equipment costs or pricing data submitted are accurate, complete and current.
(d) This does not apply to terminations. See 49.113(100) and FAR Part 49.

8. PERFORMANCE OF WORK BY THE CONTRACTOR (1984 APR) FAR 52.236-1. The Contractor shall perform on the site, and with its own organization, work equivalent to at least twenty-five (25%) percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement of this contract if, during the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

SECTION 01200

GENERAL REQUIREMENTS

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

1.1 Federal Specifications (FS).

FS FF-B-575	(Rev C) Bolt, Hexogon and Square
FS FF-N-105	(Rev B; Am 3, Int Am 4) Nails, Brads, Staples and Spikes: Wire, Cut and Wrought
FS FF-N-836	(Rev D; Am 2) Nut, Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat
FS MM-L-751	(Rev H) Lumber; Softwood
FS TT-E-529	(Rev D) Enamel, Alkyd, Semi-Gloss
FS TT-P-25	(Rev E; Am 2) Primer Coating, Exterior (Undercoat for Wood, Ready-Mixed, White and Tints)

1.2 National Institute of Standards and Technology (NIST).

NIST PS 1	(1983) Construction and Industrial Plywood

1.3 U.S. Department of the Army, Corps of Engineers (COE) Engineer Manual.

COE EM 385-1-1	Safety and Health Requirements Manual (1 April 1981, Rev 1 October 1987)

2. PROJECT FACILITIES. The Contractor shall construct and/or erect the following project facilities.

2.1 Construction Signs. The signs shall be erected at the locations designated by the Contracting Officer as soon as possible and within 15 days after commencement of work under this contract.

2.1.1 One Project sign.

2.1.2 Deleted.

2.2 Bulletin Board at the Contractor's office.

2.3 Sanitary Facilities.

3. CONSTRUCTION SIGNS.

3.1 Materials.

3.1.1 Lumber shall conform to FS MM-L-751, and shall be seasoned Douglas Fir, S4S, Grade D or better except that posts, braces and spacers shall be construction Grade (WCLB).

3.1.2 Plywood shall conform to NIST PS 1, grade A-C, Group 1, exterior type.

3.1.3 Bolts, Nuts and Nails. Bolts shall conform to FS FF-B-575, nuts shall conform to FS FF-N-836, and nails shall conform to FS FF-N-105.

3.1.4 Paints and Oils. Paints shall conform to FS TT-P-25 for primer and FS TT-E-529 for finish paint and lettering.

3.2 Construction. Project, safety, and hard hat signs shall be constructed as detailed on the drawings attached at the end of this section. Decals will be furnished by the Contracting Officer.

3.3 Painting. All exposed surfaces and edges of plywood shall be given one coat of linseed oil and be wiped prior to applying primer. All exposed surfaces of signs and supports shall be given one coat of primer and 2 finish coats of white paint. Except as otherwise indicated, lettering on all signs shall be black and sized as indicated.

4. BULLETIN BOARD. A weatherproof bulletin board, approximately 36 inches wide and 30 inches high, with hinged glass door shall be provided adjacent to or mounted on the Contractor's project office. If adjacent to the office, the bulletin board shall be securely mounted on no less than 2 posts. Bulletin board and posts shall be painted or have other approved factory finish. The bulletin board shall be easily accessible at all times and shall contain wage rates, equal opportunity notice, and such other items required to be posted.

5. MAINTENANCE AND DISPOSAL OF PROJECT FACILITIES. The Contractor shall maintain the project facilities in good condition throughout the life of the project. Upon completion of work under this contract, the facilities covered under this section will remain the property of the Contractor and shall be removed from the site at his expense.

6. SCRAP MATERIAL. Materials indicated to be removed and not indicated to be salvaged, stored or reinstalled are designated as scrap and shall become the property of the Contractor and be removed from the site of work. The Contractor by signing this contract hereby acknowledges that he made due allowance for value, if any, of such scrap in the contract price.

7. SALVAGE MATERIALS. All materials and/or equipment removed and indicated to be either stored or reinstalled are designated as salvaged materials and/or equipment. Any salvaged materials and equipment which are excess upon completion of the work and are not indicated to be stored shall become the property of the Contractor.

8. ARCHAEOLOGICAL FINDINGS DURING CONSTRUCTION. **All construction activities shall be restricted to the designated construction area. Should archaeological remains be uncovered, the Contractor shall suspend operations at the site of discovery and**

continue operations in other areas. The removal of any Indian burial grounds or remains, ceremonial objects, petroglyphs, and archaeological and other artifacts of like nature found within the construction areas will be accomplished by the Government. In the event the Contractor's operations uncover, or his employees find any of the above described objects or materials within the construction areas, it shall be incumbent on the Contractor to notify immediately the Project Engineer or his authorized representative as to what has been found. The Project Engineer, when so notified of such findings, will determine the disposition in accordance with prescribed regulations. Any remains from burials, including Indian ceremonial objects, or other remains of the like nature found within the construction area, shall not be destroyed or removed. Should petroglyphs or archaeological material be discovered, the Contractor shall modify his operations so as not to disturb the findings pending receipt of notification from the Project Engineer of his determination of the final disposition of such findings. Any discoveries of the anthropological or archaeological nature upon the rights-of-way or upon Government property shall remain the property of the Government and not become the property of the person or persons making the discovery. Should the discovery site require archaeological studies resulting in delays and/or additional work, the Contractor will be compensated by an equitable adjustment under the CONTRACT CLAUSES of the contract.

9. PUBLIC UTILITIES, NOTICES, AND RESTRICTIONS.

9.1 General. The approximate location of all railroads, pipe lines, power and communication lines, and other utilities known to exist within the limits of the work are indicated on the drawings. The sizes, locations, and names of owners of such utilities are given from available information, but their accuracy is not guaranteed. Except as otherwise indicated on the drawings, all existing utilities will be left in place and the Contractor shall conduct his operations in such a manner that the utilities will be protected from damage at all times, or arrangements shall be made by the Contractor for their relocation at the Contractor's own expense. The Contractor shall be responsible for any damage to utilities known to exist and shall reimburse the owners for such damage caused by his operations.

9.2 Relocation or Removal. Utilities to be relocated or removed not as part of this contract are designated "To be Relocated by Others" or "To be Removed by Others", respectively. Utilities shown on the plans and not so designated will be left in place and be subject to the provisions of the CONTRACT CLAUSE: PROTECTION OF EXISTING VEGETATION, STRUCTURES, UTILITIES, AND IMPROVEMENTS. The Contractor may make arrangements with the owner for the temporary relocation and restoration of utilities not designated to be relocated, or for additional work in excess of the work needed to relocate utilities designated for relocation at no additional cost to the Government.

9.3 Utilities Not Shown. If the Contractor encounters, within the construction limits of the entire project, utilities not shown on the plans and not visible as of the date of this contract and if such utilities will interfere with construction operations, he shall immediately notify the Contracting Officer in writing to enable a determination by the Contracting Officer as to the necessity for removal or relocation. If such utilities are left in place, removed or relocated, as directed by the Contracting Officer, the Contractor shall be entitled to an equitable adjustment for any additional work or delay.

3.3 PROTECTION OF FISH AND WILDLIFE RESOURCES

The Contractor shall keep construction activities under surveillance, management and control to minimize interference with, disturbance to and damage of fish and wildlife. Species that require specific attention along with measures for their protection will be listed by the Contractor prior to beginning of construction operations.

3.4 PROTECTION OF AIR RESOURCES

The Contractor shall keep construction activities under surveillance, management and control to minimize pollution of air resources. All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with the State of Arizona, Maricopa County and all Federal emission and performance laws and standards. Special management techniques as set out below shall be implemented to control air pollution by the construction activities which are included in the contract.

3.4.1 Particulates

Dust particles, aerosols, and gaseous by-products from all construction activities, processing and preparation of materials, such as from asphaltic batch plants, shall be controlled at all times, including weekends, holidays and hours when work is not in progress. **A permit will be required by the Maricopa County Bureau of Pollution Control that will require pollution suppression.** Any permits required shall be obtained by the Contractor. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards mentioned in the paragraph: PROTECTION OF AIR RESOURCES to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times. The Contractor must have sufficient competent equipment available to accomplish this task. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

3.4.2 Hydrocarbons and Carbon Monoxide

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

3.4.3 Odors

Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

3.4.4 Monitoring Air Quality

Monitoring of air quality shall be the responsibility of the Contractor. All air areas affected by the construction activities shall be monitored by the Contractor.

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shall also be the same as, or prior to, the DATA DATE contained in the Project Record (see paragraph 3.12.3.2.b.2.).

(4) An ACTUAL FINISH DATE is required for all Completed activities. If the REMAINING DURATION of an activity is zero, then there must be an ACTUAL FINISH DATE. The ACTUAL FINISH DATE must be the same as, or later than the PROJECT START date contained in the Project Record (see paragraph 3.12.3.2.b.8.). The ACTUAL FINISH DATE must also be the same as, or prior to the DATA DATE contained in the Project Record (see paragraph 3.12.3.2.b.2.).

(5) A REMAINING DURATION is required for all in-progress activities. Activities completed, based on time, shall have a zero (0) REMAINING DURATION.

(6) Cost progress is contained in the field COST TO DATE. If there is an ACTUAL START DATE, then there must also be some value for COST TO DATE. The COST TO DATE is not tied to REMAINING DURATION. For example, if the REMAINING DURATION is "0", the COST TO DATE may only be 95% of the ACTIVITY COST. This difference may be used to reflect 5% retainage for punch list items.

i. File End Record:

(1) The File End Record shall be used to identify that the data file is completed. This record shall be the last record of the entire data file. The File End record shall have the following format:

Description	Column Position	Max. Len.	Reqd. Value	Type	Just.
RECORD IDENTIFIER	1- 3	3	END	Fixed	

(2) The RECORD IDENTIFIER for the File End Record shall be "END". No data contained in the data exchange file that occurs after this record is found shall be used.

3.13 IMPLEMENTATION OF GOVERNMENT RESIDENT MANAGEMENT SYSTEM

The Contractor shall utilize a Government furnished CQC Daily Report Form. This form may be in addition to other Contractor desired reporting forms. However, all other such reporting forms shall be consolidated into this one daily Government furnished CQC Report Form. The Contractor will also be required to complete Government-Furnished Input Forms which lists, but is not limited to, Prime Contractor staffing; letter codes; planned cumulative progress earnings; subcontractor information showing trade, name, address, and insurance expiration dates; definable features of work; pay activity and activity information; required Quality Control tests tied to individual activities; planned User Schooling tied to specific specification paragraphs and Contractor activities; and submittal information relating to specification section, description, activity number, review period and expected procurement period. The sum of all activity values shall equal the contract amount, and all Bid Items and Additives shall be separately identified, in accordance with the "Bidding Schedule". These forms shall be completed to the satisfaction of the Contracting Officer prior to any contract payment (except for Bonds, Insurance and/or Mobilization, as approved by the Contracting Officer) and shall be updated as required. See example forms at the end of this section.

3.13.1 During the course of the contract, the Contractor will receive various Quality Assurance comments from the Government that will reflect corrections needed to Contractor activities or reflect outstanding or future items needing the attention of the Contractor. The Contractor will acknowledge receipt of these comments by specific number reference on his Daily CQC Report, and will also reflect on his Daily CQC Report when these items are specifically completed or corrected.

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SECTION 02660

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3.1.9.1 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 shall be protected by galvanizing or by coating with bituminous paint.

3.1.9.2 Restrained Joints

For ductile-iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA-01.

3.1.10 Irrigation Lines and Appurtenances

Irrigation lines and appurtenances are shown schematically on the project plans. Prior to installation, the Contractor shall furnish shop drawings, at a scale acceptable to the Contracting Officer, showing the intended dimensional location of all main and lateral lines (other than driplines) and all other irrigation appurtenances. Shop drawings, if prepared in accordance with the requirements of the SPECIAL CLAUSES, may serve as the basis for "as-built" drawings.

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 150 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.

d. An unforeseeable cause which would result in excess cost.

1.2.4 Nonshrink Grout

1.2.4.1 General

Descriptive literature of the grout proposed for use shall be furnished together with a certificate from the manufacturer stating that it is suitable for the application or exposure for which it is being considered. In addition, a detailed plan shall be submitted for approval, showing equipment and procedures proposed for use in mixing and placing the grout.

1.2.4.2 Prepackaged Material

Prepackaged material requiring only the addition of water shall be accepted on the basis of certified laboratory test results showing that the material meets the requirements of ASTM C 1107. When fine aggregate is to be added, the Contractor shall also furnish for approval the design mix proportions together with certified copies of laboratory test results indicating that the mix is in conformance with the requirements of ASTM C 1107.

Data and Reports; GA.

1.2.4.3 Volume-Change Controlling Ingredient

Mixture proportions using a volume-change controlling ingredient shall be submitted for approval. The submittal shall include the design mix proportions of all ingredients and certified copies of laboratory test results indicating that the materials and the mix is in conformance with the requirements of ASTM C 1107.

Data and Reports; GA.

1.2.5 Formwork Design

Formwork design shall conform to ACI 301 and ACI 347R. Formwork for special effects shall be approved by the Contracting Officer. Design analysis and calculations for form design and methodology used in the design shall be submitted to the Contracting Officer for approval.

1.2.5.1 Detail Drawings

Detail drawings showing details conforming to ACI 315 and ACI 318 shall be submitted to the Contracting Officer for approval prior to being incorporated into the work. Detail drawings shall show location, building elevations, formwork fabrication details, reinforcements, embedments, dimensions, concrete strength, interface with adjacent materials, and special placing instructions, in sufficient detail to cover fabrication, placement, stripping and finishing. Manufacturer's data including literature describing the form materials, accessories, and form releasing agents; including the rate of application of form releasing agents shall be submitted to the Contracting Officer for approval.

1.2.5.2 Concrete Reinforcing System

Detail drawings showing reinforcing steel schedules, size, grades, and splicing and bending details shall be submitted to the Contracting Officer for approval. Drawings shall show support details including types, sizes and spacing.

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CONCRETE

SECTION 03450

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Precast Concrete Wall; GA.

Three 4'-0" x 4'-0" x 10 inch samples of precast unit finish required for the project. Samples shall show matrix color, surface color, surface texture and panel back finish. The samples shall be maintained at the job site untit approval by the Contracting Officer for removal or incoporating in the project. The mock-up shall be used to establish quality and acceptance of precast units to be used on the project and shall show the exterior finish (matrix color, surface color, surface texture and aggregate) panel back finish, edge treatment, joint treatment, reinforcement, anchorage insert, lifting inserts and other accessories.

Manufacturer's Qualifications; GA.

A statement giving the qualifications of the precast concrete manufacturer and of the installers, prior to commencing operations.

Inspection at the Site

Immediately prior to placement all precast concrete units shall be inspected for quality to insure all precast units conform to the requirements specified. Inspection for quality will include but not necessarily be limited to the following elements; color, texture, dimensional tolerances, chipping, cracking, staining, warping and honeycombing. All defective precast concrete units shall be replaced or repaired as approved.

1.5 HANDLING AND STORAGE

Precast units shall be delivered to the site with delivery scheduled to avoid excessive build-up of units in storage at the site. Upon delivery to the jobsite all precast units shall be inspected for quality as specified in paragraph: STORAGE AND INSPECTION AT MANUFACTURER'S PLANT. If the precast units cannot be unloaded and placed directly into the work, they shall be stored on site, off the ground and protected from weather, marring, or overload. Precast units shall be handled in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 MATERIALS

Except as otherwise specified, material shall conform to SECTION: CAST-IN-PLACE CONCRETE.

2.1.1 Aggregates

Aggregates for all exterior exposed architectural surfaces shall be natural crushed copper slag. The slag shall be cleaned of silt and organic impurities. It shall be a maximum size of 1-1/2 inch to a minimum of 1/2 inch with 80 percent of the aggregate used being larger than 1 inch. Evidence of the aggregate inertness, soundness and hardness shall be provided as information under SD-14, Samples - Copper Slag Aggregate of this section.

2.1.2 Reinforcing Steel

Reinforcing steel shall be galvanized if clearance to an exterior face is 1 inch or less.

2.1.3 Tie Wire

Tie wire shall be soft monel or 18-8 stainless steel.

2.1.4 Inserts

Inserts shall be manufacturer's standard, suited for the application.

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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: SUBMITTAL DESCRIPTIONS.

1.4.1 SD-08, Statements

Welding Procedure Qualifications; GA.

Welder, Welding Operator, and Tacker Qualification; GA.

Inspector Qualification; GA.

Copies of the welding procedure specifications; the procedure qualification test records; and the welder, welding operator, or tacker qualification test records.

1.4.2 SD-13, Certificates

Welding certificates are required; FIO.

1.4.3 SD-18, Records

Quality Control; GA.

A quality assurance plan and records of tests and inspections.

1.5 WELDING PROCEDURE QUALIFICATIONS

Except for prequalified (per AWS D1.1) and previously qualified procedures, each Contractor performing welding shall record in detail and shall qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Qualification of welding procedures shall conform to AWS D1.1 and to the specifications in this section. Copies of the welding procedure specification and the results of the procedure qualification test for each type of welding which requires procedure qualification shall be submitted for approval. Approval of any procedure, however, will not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the requirements of these specifications. This information shall be submitted on the forms in Appendix E of AWS D1.1. Welding procedure specifications shall be individually identified and shall be referenced on the detail drawings and erection drawings, or shall be suitably keyed to the contract drawings. In case of conflict between this specification and AWS D1.1, this specification governs.

1.5.1 Previous Qualifications

Welding procedures previously qualified by test may be accepted for this contract without requalification if the following conditions are met:

a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

2.3 ADHESIVES AND CONCRETE PRIMER

Adhesive and concrete primer for installation of carpet shall be waterproof, nonflammable, and as recommended by the carpet manufacturer. Seam adhesive shall be waterproof, nonflammable, and nonstaining as recommended by the carpet manufacturer.

2.4 MOLDING

Molding shall be aluminum. Aluminum molding shall be a hammered surface, pinless clamp-down type, designed for the type of carpet being installed. Finish shall be natural color anodized. Floor flange shall be a minimum 1-1/2 inches wide and face shall be a minimum 5/8 inch wide. **At carpet transition to concrete floor to have a vinyl edge strip. Color to match the carpet.**

2.5 TAPE

Tape for seams shall be as recommended by the carpet manufacturer for the type of seam used in installation.

PART 2 EXECUTION

2.1 SURFACE CONDITIONS

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, or rough areas shall be repaired using material recommended by the carpet or adhesive manufacturer. Floor shall be free of any foreign materials and swept broom clean.

2.2 MOISTURE TEST

After concrete floor surfaces have been cleaned, small patches of adhesive to be used shall be spread in several locations in each area and allowed to dry overnight. If the adhesive can be peeled easily from the floor surfaces, the floor is not sufficiently dry. The test shall be repeated until the adhesive adheres properly. When the adhesive adheres tightly to the floor surface, the carpet shall be applied. Where concrete floors are in contact with the ground or over unventilated crawl spaces, small patches of primer shall be used in lieu of adhesive to test for moisture.

2.3 INSTALLATION

Installation shall be in accordance with the manufacturer's instructions and CRI-104.

2.3.1 Carpet

Carpet shall be installed direct glue down and shall be smooth, uniform, and secure, with a minimum of seams. Side seams shall be run toward the light where practical and where such layout does not increase the number of seams. Breadths shall be installed parallel, with carpet pile in the same direction. Patterns shall be accurately matched. Cutouts, as at door jambs, columns and ducts shall be neatly cut and fitted securely. Seams at doorways shall be located parallel to and centered directly under doors. Seams shall not be made perpendicular to doors or at pivot points. Seams at changes in directions of corridors shall follow the wall line parallel to the carpet direction.

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SECTION 16415

ELECTRICAL WORK, INTERIOR

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C82.1	(1985; C82.1a; C82.1b; C82.1c) Ballasts for Fluorescent Lamps
ANSI C82.4	(1985; C82.4a) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple Supply Type)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

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 AB 1	(1986; Rev 1) Molded Case Circuit Breakers and Molded Case Switches
NEMA FU 1	(1986) Low Voltage Cartridge Fuses
NEMA ICS 1	(1988; Rev 1 & 2) Industrial Controls and Systems
NEMA ICS 2	(1988; Rev 1) Industrial Control Devices, Controllers and Assemblies
NEMA ICS 3	(1988; Rev 1) Industrial Systems
NEMA ICS 6	(1988; Rev 1) Enclosures for Industrial Control and Systems
NEMA LE 4	(1987) Recessed Luminaires, Ceiling Compatibility
NEMA MG 1	(1987; Rev 1) Motors and Generators

NEMA MG 10	(1983; R 1988) 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 PB 1	(1990; PB 1.1) Panelboards
NEMA PB 2	(1989; PB 2.1) Deadfront Distribution Switchboards
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	(1986) Electrical Nonmetallic Tubing (ENT)
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	(1990) National Electrical Code
NFPA 101	(1991) Safety to Life from Fire in Buildings and Structures

UNDERWRITERS LABORATORIES (UL)

UL-03	(1991; Supple) Electrical Construction Materials Directory
UL 1	(1985; Rev Jan 1992) Flexible Metal Conduit
UL 5	(1985; Rev thru Sep 1990) Surface Metal Raceways and Fittings
UL 6	(1981; Rev thru Jul 1991) Rigid Metal Conduit
UL 20	(1986; Rev thru Jul 1991) General-Use Snap Switches

UL 44	(1991; Rev Oct 1991) Rubber-Insulated Wires and Cables
UL 50	(1988; Rev thru Mar 1991) Cabinets and Boxes
UL 67	(1988; Rev thru Jul 1991) Panelboards
UL 83	(1991; Rev Sep 1991) Thermoplastic-Insulated Wires and Cables
UL 98	(1987; Rev thru Apr 1990) Enclosed and Dead-Front Switches
UL 198C	(1986; Rev thru Jun 1990) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1988; Rev Jul 1988) High-Interrupting-Capacity Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198G	(1988; Rev May 1988) Fuses for Supplementary Overcurrent Protection
UL 360	(1986; Rev thru Feb 1990) Liquid-Tight Flexible Steel Conduit
UL 467	(1984; Rev thru Nov 1986) Grounding and Bonding Equipment
UL 486A	(1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1991; Rev Oct 1991) Wire Connectors for Use with Aluminum Conductors
UL 486C	**(1991; Rev thru Jan 1992) Splicing Wire Connectors**
UL 489	(1991; Rev thru May 1992) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 506	(1989; Rev Jan 1990) Specialty Transformers
UL 508	(1989; Rev thru Jan 1992) Industrial Control Equipment
UL 510	(1986; Rev Oct 1986) Insulating Tape

UL 1660 (1987) Liquid-Tight Flexible Nonmetallic Conduit

1.2 GENERAL

Furnish and install all electrical equipment as indicated on the contract drawings and in accordance with this specification.

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 Electrical Contractor shall coordinate the electrical work with HVAC and electrical drawings and provide all power related wiring even if they are not shown on the electrical drawings.

1.2.3 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.

1.2.4 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, all identification nameplates shall be made of laminated plastic 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 following equipment, as a minimum, shall be provided with identification nameplates:

2.1.14 Receptacles

2.1.14.1 General Grade

NEMA WD 1.

2.1.14.2 Ground Fault Interrupters

UL 943, Class A or B.

2.1.15 Service Equipment

UL 869A.

2.1.16 Splice, Conductor

UL 486C.

2.1.17 Switchboard, Dead Front Distribution

NEMA PB 2 and UL 891.

2.1.18 Snap Switches

UL 20.

2.1.19 Tapes

2.1.19.1 Plastic Tape

UL 510.

2.1.19.2 Rubber Tape

UL 510.

2.1.20 Transformers, Conventional Dry-Type

Specialty or General Applications: NEMA ST 20 and UL 506 unless otherwise shown or specified.

2.1.21 Wiring Devices

NEMA WD 1 for general-purpose 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.

2.5.2.1 Duct Detectors

Detectors shall be designed for detection of abnormal smoke densities. Each duct detector shall activate a visual ammunciator on the control panel in the case of abnormal smoke density. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind.

2.6 NOTIFICATION APPLIANCES

Audible appliances shall be heavy duty and conform to the applicable requirements of UL 464. Devices shall be connected into alarm indicating circuits. All devices shall have a separate screw terminal for each conductor. **All shall be painted red similar to FED-STD 595 color, number 11105.**

2.6.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box recessed grill and vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a minimum sound rating of at least 100 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.

2.6.2 Visual Notification Appliances

Visual notification appliances shall have high intensity optic lens and flash tubes. Strobes shall flash at approximately 2 flash per second and a minimum of 1 candela (8,000 peak candle power). Strobe shall be semi-flush mounted.

2.6.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. All units shall be factory assembled. Any other audible indicating appliance employed in the fire alarm systems shall be approved by the authority having jurisdiction.

2.7 REMOTE ANNUNCIATION EQUIPMENT

2.7.1 Remote Annunciator

Annunciator shall have relampable indicator lamps. The lamp (LED) for the proper zone shall light upon any alarm, supervisory or trouble condition on the fire alarm system. Annunciator lamps shall be extinguished only by operating the alarm reset switch on the control panel. Annunciator shall contain a lamp test switch, an audible trouble signal and a trouble silence switch to silence the audible alarm, but not extinguish the trouble lamp. Switches shall be located within a locked panel, and easily visible through a glass or plastic viewing plate. Panel door shall have a keyed lock identical to the lock on the control panel. Zone identification shall be by silk-screened or engraved labels and shall consist of word description of the zone. Annunciator shall be flush mounted.

e. Start-up operations.

f. Expansion capability and method of implementation.

1.4 TESTING

1.4.1 General

The Contractor shall perform predelivery testing, site testing, and adjustment of the completed EECS. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the Government at least 14 days prior to the test, and in no case shall notice be given until after the Contractor has received written approval of the specific test procedures.

1.4.2 Test Procedures and Reports

Test procedures shall explain in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification. Test reports shall be used to document results of the tests. Reports shall be delivered to the Government within 7 days after completion of each test.

Test Results; FIO.

1.5 TRAINING

1.5.1 General

The Contractor shall conduct training courses for designated personnel in the maintenance and operation of the EECS as specified. The training shall be oriented to the specific system being installed under this contract. Training manuals shall be delivered for each trainee with two additional copies delivered for archiving at the project site. The manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. The Contractor shall furnish audio-visual equipment and other training materials and supplies. Where the Contractor presents portions of the course by audio-visual material, copies of the audio-visual material shall be delivered to the Government either as a part of the printed training manuals or on the same media as that used during the training sessions. 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. For guidance in planning the required instruction, the Contractor should assume that attendees will have a high school education or equivalent, and are familiar with EECS. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

1.5.2 Operator's Training I

The first course shall be taught at the project site for a period of 1 training day. Upon completion of this course, each student, using appropriate documentation, should be able to perform elementary operations with guidance and describe the general hardware architecture and functionality of the system. This course shall include:

General Decision Number AZ910001

Superseded General Decision No. AZ900001

State: Arizona

Construction Type:
Building

County(ies):
MARICOPA

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
1	03/15/1991
2	05/24/1991
3	11/15/1991
4	12/13/1991
5	10/02/1992
6	10/16/1992

COUNTY(ies):
MARICOPA

ASBE0073A 08/01/1990

	Rates	Fringes
ASBESTOS WORKERS	13.50	3.83

BOIL0627B 10/01/1992

	Rates	Fringes
BOILERMAKERS	20.21	6.50

CARP0857D 06/01/1992

	Rates	Fringes
CARPENTERS:		
Carpenters	15.70	3.01
Piledrivermen	16.05	3.01

ELEV0140A 08/28/1992

	Rates	Fringes
ELEVATOR CONSTRUCTION:		
Mechanic	17.04	6.12 + a
Helper	11.93	6.12 + a
Helper (Probationary)	8.52	

FOOTNOTES FOR ELEVATOR CONSTRUCTION:
a. SEVEN PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, and Christmas Day.
VACATION PAY CREDIT: Employer contributes 8% of basic hourly rate for employees with more than 5 years of service, and 6% for 6 months to 5 years of service.

ENGI0428A 06/01/1992

	Rates	Fringes
POWER EQUIPMENT OPERATORS:		
Group 1	12.67	3.33
Group 2	15.50	3.33
Group 3	16.47	3.33
Group 4	17.37	3.33

DEFINITION OF GROUPS:

GROUP 1: A-frame boom truck, winch truck, air compressor, Beltcrete, boring bridge and texture, concrete mixer (skip type), conductor, brakeman, handler, conveyor, cross timing and pipe float, curing machine, dinky (under 20 tons), elevator hoist (Husky and similar), firemen (all), forklift and Ross carrier, generator (all), highline cableway signalman, hydrographic mulcher, hydrographic seeder, joint inserter, jumbo finishing machine, Kolman belt loader, machine conveyor, multiple power concrete saw, oiler, pavement breaker, power grizzly, power sweeper, pressure grout machine, pump, roller (except as otherwise classified), self-propelled chip spreading machine, skiploader (3.5 cu. yd. and less), slurry seal machine (Moto paver driver), small self-propelled compactor (with blade) - backfill, ditch operation, straw blower, tractor (D-5 and under), tripper, tugger, welding machine, wheel-type tractor (Ford, Ferguson type with attachments, Bee Gee etc.)

GROUP 2: Aggregate plant (including crushing, screening and sand plants, etc.), asphalt plant mixer, asphalt laydown machine, backhoe (rubber tired or track, less than 1 cu. yd. MRC), boring machine, concrete batch plant (all types and sizes), concrete mechanical tamping, spreading or finishing machine (including Clary, Johnson or similar types), concrete mixer (paving type and mobile mixers), concrete pump, crane (crawler and pneumatic less than 15 ton capacity MRC), drilling machine (including water wells), elevating grader (all types and sizes except as otherwise classified), field equipment serviceman, grade checker (excluding civil engineer), paver and similar type equipment, motor grader (any type power blade - rough), oiler driver, operating engineer rigger, pneumatic tired scraper (all sizes and types), power jumbo form setter, road oil mixing machine, roller (on all types asphalt pavement), screed, self-propelled compactor (with blade, 815, 825 or equivalent - grade operation), skip loader (all types with a rated capacity over 3.5 but less than 6 cu. yd.), slip form (power driven lifting device for concrete forms), soil cement road mixing machine (single pass type), heater and planer, tractor (dozer, pusher - all), traveling pipe-wrapping machine, trenching machine, tugger (two or more)

GROUP 3: Asphalt or concrete planing, rotomill and milling machine, auto grade machine (CMI and similar equipment), boring machine (including mole, badger and similar type), concrete pump (truck mounted with boom), crane (crawler and pneumatic over 15 tons but less than 100 tons capacity MRC), crawler type tractor with boom attachment and slope bar, derrick, Gradall, heavy duty mechanic/welder, helicopter hoist operator or pilot, highline cableway, mass excavator (150 Bucyrus, Erie and similar type), mechanical hoist (two or more drums), motor grader (any type power blade - finish), mucking machine, overhead crane, piledriver engineer (portable, stationary or skid rig), power driven ditch lining or ditch trimming machine, remote control earth moving machine, skip loader (all types with rated capacity 6 cu. yd. but less than 10 cu. yd.), slip form paving machine (including Gunnert, Zimmerman and similar types), tower crane or

similar type, universal equipment operator (shovel, dragline, clamshell, etc., up to 10 cu. yd.)

GROUP 4: Crane operator (pneumatic or crawler - 100 tons hoisting capacity and over, MRC rating), skip loader (all types with rated capacity of 10 cu. yd. or more), universal equipment operator (shovel, backhoe, dragline, clamshell, etc., 10 cu. yd. and over)

IRON0075B 08/01/1992

	Rates	Fringes
IRONWORKERS:		
0-50 miles from City Hall in Phoenix or Tucson	16.00	6.55
50-100 miles	17.50	6.55
100-150 miles	18.75	6.55
over 150 miles	20.00	6.55

PAIN0086A 01/01/1992

	Rates	Fringes
PAINTER:		
Commercial	13.25	1.25
Industrial	16.17	1.25

PAIN1610A 07/01/1992

	Rates	Fringes
GLAZIERS	$15.11	2.35

PLAS0394F 06/01/1987

	Rates	Fringes
CEMENT MASONS:		
Cement Masons	16.005	3.05
Concrete Troweling Machine, Sawing and Scoring Machine, Curb and Gutter Machine	16.24	3.05

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* PLUM0469A 07/01/1992

	Rates	Fringes
PLUMBERS & PIPEFITTERS:		
ZONE 1:		
Commercial	17.85	5.40
Industrial	20.84	5.40
ZONE 2:		
Commercial	20.85	5.40
Industrial	23.84	5.40

ZONE DEFINITIONS FOR PLUMBERS AND PIPEFITTERS:

ZONE 1: Area within a 20 mile radiusof the center of the

following towns: Flagstaff, Holbrook, Kingman, Lake Havasu City, Prescott, Show Low, Springerville, St Johns, Winslow, and Yuma; and area within 40 miles of the center of Phoenix

ZONE 2: Area outside a 20 mile radius of the center of the following towns: Flagstaff, Holbrook, Kingman, Lake Havasu City, Prescott, Show Low, Springerville, St Johns, Winslow, and Yuma; and area outside a 40 mile radius of the center of Phoenix

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SFAZ0669A 04/01/1992

	Rates	Fringes
SPRINKLER FITTERS	19.85	5.58

SHEE0359A 01/01/1991

	Rates	Fringes
SHEET METAL WORKERS:		
Zone 1	17.55	3%+4.19
Zone 2	18.80	3%+4.19
Zone 3	21.55	3%+4.19

ZONE DEFINITIONS:

Zone 1: 0 to 35 miles from the city hall or city administration building in Flagstaff, Kingman, Prescott, Lake Havasau City, and Yuma; and from the intersection of Central and Washington in Phoenix

Zone 2: 35 to 65 miles from the cities listed above

Zone 3: Over 65 miles from the cities listed above

SUAZ1003A 11/05/1991

	Rates	Fringes
BRICKLAYERS	11.50	3.04
ELECTRICIANS	12.18	1.32
INSULATION INSTALLER	8.57	
LABORERS	7.55	
LANDSCAPE SPRINKLER INSTALLER	6.65	
LANDSCAPE LABORER	4.59	
PLASTERERS	15.69	3.06
ROOFERS	10.84	2.11
SOFT FLOOR LAYERS	12.46	.92
TILE, MARBLE & TERRAZZO WORKERS	13.74	2.76
TILE FINISHERS	11.77	1.79

TEAM0104A 06/01/1990

	Rates	Fringes
TRUCK DRIVERS:		
GROUP 1	7.62	2.87

GROUP 2	10.82	2.87
GROUP 3	15.26	2.87

TRUCK DRIVERS CLASSIFICATION DEFINITIONS:

GROUP 1: Pickup Driver, Station Wagon Driver, Man Haul Driver, 4 axle or less Dump or Flattrack Driver, Self-propelled street sweeper, tireman, Water Truck Driver, Transit Mix Driver, 8 cy or less Mixer capacity, Ambulance Driver.

GROUP 2: Transit Mix Driver, over 8 cy, Rock Truck Driver-under 35 tons, Oil Tanker or Spreader Truck Driver and/or Bottman, Retortman or Leverman,, 5 axle Dump or Flatrack Driver, Water Truck Driver 3900 gal and over, Off-Highway Equipment Driver including but not limited to: 2 or 4 Wheel Power Unit, i.e., Cat DW Series, Euclid, Int'l and Similar type Equipment, Transporting Material when top loaded or by External Means, Including Pulling Water tanks, Fuel Tanks or other applications under Teamster Classificaiton

GROUP 3: Field Equipment Serviceman or Fuel Truck Driver, Heavy Duty Mechanic/Welder, Transport Driver (Heavy Equipment), Off Highway Rock Truck-35 tons and over

Combination men shall be paid thirty cents ($.30) over the highest rated work.

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

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

END OF GENERAL DECISION

PROJECT NAME : _____ 06 Oct 92
LOCATION : _____
CONTRACT NO. : _____

CONTRACTOR PLANNING INFORMATION

PRIME CONTRACTOR

Prime Contractor : _____
Full Name & Address : _____
_____
_____

County : _____

PRIME CONTRACTOR STAFFING

Project Manager _____ Phone _____

Superintendent _____ Phone _____
Assist. Supt. _____

Quality Control Staff:

QC Name	Category Assignments	Category Codes
_____	, , , , , , , ,	A = ARCHITECTURAL
		E = ELECTRICAL
_____	, , , , , , , ,	P = PLUMBING
		M = MECHANICAL
_____	, , , , , , , ,	F = FIRE SPRINKLER
		S = STRUCTURAL
_____	, , , , , , , ,	R = ROOFING
		C = CIVIL
		T = SAFETY

CONTRACTOR LETTER CODES

LETTER from SITE OFFICE : _____
LETTER from HOME OFFICE : _____

MONTHLY PROGRESS SCHEDULE

Sep 1991 -	Sep 1992 -	Sep 1993 -
Oct 1991 -	Oct 1992 -	Oct 1993 -
Nov 1991 -	Nov 1992 -	Nov 1993 -
Dec 1991 -	Dec 1992 -	Dec 1993 -
Jan 1992 -	Jan 1993 -	Jan 1994 -
Feb 1992 -	Feb 1993 -	Feb 1994 -
Mar 1992 -	Mar 1993 -	Mar 1994 -
Apr 1992 -	Apr 1993 -	Apr 1994 -
May 1992 -	May 1993 -	May 1994 -
Jun 1992 -	Jun 1993 -	Jun 1994 -
Jul 1992 -	Jul 1993 -	Jul 1994 -
Aug 1992 -	Aug 1993 -	Aug 1994 -

Encl. 3 to Amend. No.: 0001

SUBCONTRACTOR INFORMATION

06 Oct 92

ABBREVIATED NAME	TRADE	FULL NAME	STREET ADDRESS	CITY,STATE AND ZIPCODE	AUTO INS. EXPIRES	LIABILITY EXPIRES	WORKMENS EXPIRES	LABOR INTERVIE

CONTRACTOR PLANNING (6)

GOVERNMENT PLANNING (5)

Encl. 3 to Amend. No.: 0001

FEATURE OF WORK	ESTIMATED START	PREPARATORY TO INITIAL	FEATURE OF WORK	ESTIMATED START	PREPARATORY TO INITIAL

Encl. 3 to Amend. No.: 0001

PAY ACTIVITIES AND ACTIVITY INFORMATION

06 Oct 92

ACTIVITY NUMBER	ACTIVITY DESCRIPTION	BID ITEM #	$ AMOUNT OR QUANTITY	UNIT	FEATURE OF WORK	WORK CATEGORY	(SUB)CONTRACTOR	PROJECT AREA	CONTRACT PHASE	WORK TYPE 1	WORK TYPE 2	WORK TYPE 3

CONTRACTOR PLANNING (9 & 11)

GOVERNMENT PLANNING (10)

Encl. 3 to Amend. No.: 0001

SUBMITTAL INFORMATION

06 Oct 92

SECTION	ITEM NUMBER	DESCRIPTION	PARAGRAPH	TYPE	ACTIVITY NUMBER	PROCUREMENT PERIOD	REVIEWING OFFICE	REVIEWER	REVIEW PERIOD

CONTRACTOR PLANNING (15)

GOVERNMENT PLANNING (13) PAGE 1 OF

Encl. 3 to Amend. No.: 0001

QUALITY CONTROL TESTING INFORMATION

06 Oct 92

TEST	ACTIVITY NUMBER	SPEC. SECTION	SPEC. PARAGRAPH	PERFORMED BY	TEST	ACTIVITY NUMBER	SPEC. SECTION	SPEC. PARAGRAPH	PERFORMED BY

Encl. 3 to Amend. No.: 0001

SCHOOL	ACTIVITY NUMBER	SPECIFICATION SECTION	SPECIFICATION PARAGRAPH	REMARKS

Encl. 3 to Amend. No.: 0001

CONTRACTOR QUALITY CONTROL REPORT

	REPORT NO.
	DATE
PROJECT/CONTRACT NUMBER	SUPERINTENDENT
ONTRACTOR	WEATHER

PRECIPITATION PAST 24 HOURS (IN INCHES) TEMPERATURE °F MINIMUM MAXIMUM

WERE THERE ANY DELAYS IN WORK PROGRESS TODAY? No ___ Yes___ If Yes, Explain:

VERBAL INSTRUCTIONS GIVEN BY THE GOVERNMENT:

HAS ANYTHING DEVELOPED WHICH MIGHT LEAD TO A CHANGE ORDER OR CLAIM? No___ Yes___ If Yes, Explain:

NOTE: Official notification of claim must be made to the Contracting Officer by seperate correspondence.

SAFETY INSPECTION/MEETINGS: Indicate inspections made, items inspected, deficiencies noted and corrective action taken.

WERE THERE ANY LOST TIME ACCIDENTS THIS DATE? No___ Yes___ If Yes, attach accident report.

PRIME CONTRACTOR/SUBCONTRACTOR WORKFORCE
(If space provided below is inadequate, use additional sheets)

No.	TRADE	HOURS	EMPLOYER	No.	TRADE	HOURS	EMPLOYER

CUMULATIVE TOTAL HOURS OF WORK HOURS FROM PREVIOUS REPORT

TOTAL WORK HOURS ON JOB SITE THIS DATE

TOTAL WORK HOURS FROM START OF CONSTRUCTION

MAJOR ITEMS OF EQUIPMENT

TYPE/CAPACITY	No.	STANDBY HOURS	OPERATING HOURS

9. THREE PHASE INSPECTION

ADVANCE NOTICE OF PREPARATORY, INITIAL OR FINAL FOLLOW-UP INSPECTION: (minimum five working days notice required)

PREPARATORY INSPECTION HELD TODAY: Indicate Definable Features of Work. Attach Preparatory Checklist.

INITIAL INSPECTION HELD TODAY: Indicate Definable Features of Work. Attach Initial Checklist.

FINAL FOLLOW-UP INSPECTION HELD TODAY: Indicate NAS Activity Number. Attach Final Follow-up Checklist.

10. ACTIVITIES IN PROGRESS: Attach daily CQC follow-up inspection deficiencies/corrections noted.

ACTIVITY NUMBER	S=START C=CONTINUING F=FINISH	DESCRIPTION OF WORK ACTUALLY PERFORMED/MAJOR MATERIAL DELIVERIES TODAY

11. CQC TESTING

ACTIVITY NUMBER	DESCRIPTION OF TESTS PERFORMED	PASSED/FAILED

12. USER SCHOOLING CONDUCTED:

ACTIVITY NUMBER	DESCRIPTION OF SCHOOLING

13. INSTALLED PROPERTY PRICING DATA ATTACHED: YES___ NO___

14. TRANSFERRED PROPERTY, DD-1149 ATTACHED: YES___ NO___

15. QA COMMENTS CORRECTED TODAY: YES___ NO___

16. EQUIPMENT SAFETY CHECKLIST ATTACHED: YES___ NO___

GENERAL COMMENTS:

CONTRACTOR CERTIFICATION: On behalf of the contractor, I certify that this report is complete and correct and all equipment and material used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

Authorized Contractor Representative: _____

Report Date: _____ Date Submitted to Government Representative: _____

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
N/A	1 / 3

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
0002	13 NOV 92	N/A	Spec No: W93B0003

6. ISSUED BY CODE

U.S. ARMY ENGINEER DISTRICT, LOS ANGELES
P.O. Box 2711
Los Angeles, California 90053-2325

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.
DACW09-93-B-0003

9B. DATED (SEE ITEM 11)
01 DEC 92 (Bid Opening)

10A. MODIFICATION OF CONTRACT/ORDER NO.
N/A

10B. DATED (SEE ITEM 13)
N/A

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☒ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT 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.

(X) 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 AUTHORITY OF:

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.)

HEDGEPETH HILLS CULTURAL RESOURCES INTERPRETIVE CENTER, Maricopa County, Arizona

1 Encl:
1. Replacement pages 00010-1 and 00010-2.

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)	
CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED

SOLICITATION, OFFER AND AWARD (Construction, Alteration, or Repair)	1. SOLICITATION NO.	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF PAGES
	DACW09-93-B-0003	☒ SEALED BID (IFB) ☐ NEGOTIATED (RFP)	16 OCT 92	1 of 3

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

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

7. ISSUED BY	CODE	8. ADDRESS OFFER TO
U.S. ARMY ENGINEER DISTRICT, LOS ANGELES P.O. Box 2711 Los Angeles, California 90053-2325		U.S. ARMY ENGINEER DISTRICT, LOS ANGELES Phoenix Office 3636 N. Central Avenue, Room 760 Phoenix, Arizona 85012-1936

9. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS)
	See "INSTRUCTIONS TO BIDDERS"	

SOLICITATION

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

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

HEDGPETH HILLS CULTURAL RESOURCES INTERPRETIVE CENTER (CRIC), Maricopa County, Arizona

The work consists of construction of a cultural interpretive center, including grading; excavation, trenching, and backfilling for utility systems; concrete pavement and steps; water lines and sanitary sewers; tilt-up concrete walls with exposed aggregate exterior face; structural steel work; carpentry; single-ply roof membrane with gravel balast on rigid insulation on acoustical metal decking; steel doors and frames, glass, and glazing; acoustical ceiling; carpet; painting; bathroom fixtures; general plumbing and air-conditioning system; electrical work; planting of trees, shrubs and wildflowers; irrigation system, decomposed granite paths and pavement and chain-link fencing.

The estimated cost of construction is between $1,000,000 and $5,000,000.

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

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

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and no copies to perform the work required are due at the place specified in Item 8 by 1:00 PM (hour) local time 01 DEC 92 (date). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

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

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

Offers providing less than 60 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER (Must be fully completed by offeror)

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

CODE FACILITY CODE

15. TELEPHONE NO. (Include area code)

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

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

AMOUNTS ▶ In accordance with the attached BIDDING SCHEDULE.

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

19. ACKNOWLEDGMENT OF AMENDMENTS
(The offeror acknowledges receipt of amendments to the solicitation – give number and date of each)

AMENDMENT NO.										
DATE										

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER (Type or print)

20B. SIGNATURE

20C. OFFER DATE

AWARD (To be completed by Government)

21. ITEMS ACCEPTED:

22. AMOUNT

23. ACCOUNTING AND APPROPRIATION DATA

24. SUBMIT INVOICES TO ADDRESS SHOWN IN (4 copies unless otherwise specified) ▶

ITEM

25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO

☐ 10 USC 2304(c)( ) ☐ 41 USC 253(c)( )

26. ADMINISTERED BY CODE

27. PAYMENT WILL BE MADE BY

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT (Contractor is required to sign this document and return _____ copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.

☐ 29. AWARD (Contractor is not required to sign this document.) Your offer on this solicitation, is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Tpye or print)

31A. NAME OF CONTRACTING OFFICER (Type or print)

30B. SIGNATURE

30C. DATE

31B. UNITED STATES OF AMERICA
BY

31C. AWARD DATE

STANDARD FORM 1442 BACK (REV. 4-85)

Encl. 1 to Amend. No.: 0002

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE: N/A			PAGE OF PAGES: 1 of 7
2. AMENDMENT/MODIFICATION NO.: 0003	3. EFFECTIVE DATE: 19 NOV 92	4. REQUISITION/PURCHASE REQ. NO.: N/A	5. PROJECT NO. (If applicable): Spec No: W93B0003
6. ISSUED BY — CODE		7. ADMINISTERED BY (If other than Item 6) — CODE	

S. ARMY ENGINEER DISTRICT, LOS ANGELES
P.O. Box 2711
Los Angeles, California 90053-2325

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

CODE — FACILITY CODE

(X)

9A. AMENDMENT OF SOLICITATION NO.: DACW09-93-B-0003

9B. DATED (SEE ITEM 11): 01 DEC 92 (Bid Opening)

10A. MODIFICATION OF CONTRACT/ORDER NO.: N/A

10B. DATED (SEE ITEM 13): N/A

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☒ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT 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.

(X) 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 AUTHORITY OF:

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.)

HEDGEPETH HILLS CULTURAL RESOURCES INTERPRETIVE CENTER, Maricopa County, Arizona

1 Encl:
1. Replacement pages: 00800-1, Index to SECTION 01200, 01200-7, 01200-8, SECTION 03450 Table of Contents, and 03450-4.

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

SECTION 00800

SPECIAL CLAUSES

1. COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (1984 APR) FAR 52.212-3.

The Contractor shall be required to (a) commence work under this contract within 5 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 270 calendar days after the date of receipt of Notice to Proceed, except for seeding and planting. Seeding and planting shall be completed as soon as practicable and within the time limits stated in the Technical Provisions or as directed by the Contracting Officer. The time stated for completion shall include final cleanup of the premises.

2. LIQUIDATED DAMAGES-CONSTRUCTION (APR 1984) FAR 52.212-5.

(a) If the Contractor fails to complete the work within the time specified in the contract, or any extensions, the Contractor shall pay to the Government as liquidated damages, the sum of $470.00 for each day of delay.
(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.

3. CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS (DEC 1991) DFARS 252.236-7001.

(a) The Government--
(1) Will provide the Contractor, without charge ten sets of large-scale contract drawings and specifications except publications incorporated into the technical provisions by reference;
(2) Will furnish additional sets on request at the cost of reproduction; and
(3) May at its option, furnish the Contractor one set of reproducibles, or half-size drawings, in lieu of the drawings in paragraph (a)(1) of this clause.
(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 misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work, but shall be performed as if fully and correctly set forth and described in the drawings and specifications.

SECTION 01200

GENERAL REQUIREMENTS

Index

1. APPLICABLE PUBLICATIONS 1

2. PROJECT FACILITIES 1

3. CONSTRUCTION SIGNS 2

4. BULLETIN BOARD 2

5. MAINTENANCE AND DISPOSAL OF PROJECT FACILITIES 2

6. SCRAP MATERIAL 2

7. SALVAGE MATERIALS 2

8. ARCHAEOLOGICAL FINDINGS DURING CONSTRUCTION 2

9. PUBLIC UTILITIES, NOTICES, AND RESTRICTIONS 3

10. PUBLIC SAFETY 6

11. OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA) STANDARDS 7

12. PERMITS 7

13. DELETED. 7

14. WRITTEN GUARANTEES AND GUARANTOR'S LOCAL REPRESENTATIVE 7

15. PRICING OF CONTRACTOR-FURNISHED PROPERTY 7

16. PROJECT ENGINEER'S OFFICE 7

17. OPERATION AND MAINTENANCE MANUALS AND INSTRUCTIONS 8

-- End of Table of Contents --

11. OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA) STANDARDS. The OCCUPATIONAL SAFETY and HEALTH ACT (OSHA) STANDARDS for CONSTRUCTION (Title 29, Code of Federal Regulations Part 1926 as revised from time to time) and the Corps of Engineers General Safety and Health Requirements Manual, EM 385-1-1, are both applicable to this contract. The most stringent requirement of the two standards will be applicable.

12. PERMITS.

12.1 General. Reference is made to the article of the contract entitled "Permits and Responsibilities". The Contractor must obtain all required licenses and permits, including but not limited to those listed.

12.2 The Contractor shall obtain a Waste Water Discharge Permit from the Environmental Protection Agency (EPA). Details regarding this permit can be obtained by calling the EPA at (415) 744-1905.

13. DELETED.

14. WRITTEN GUARANTEES AND GUARANTOR'S LOCAL REPRESENTATIVE. Prior to completion of the contract, the Contractor shall obtain and furnish to the Contracting Officer's representative written guarantees for all the equipment and/or appliances furnished under this contract. The Contractor shall furnish with each guarantee: The name, address, and telephone number of the guarantor's representative nearest to the location where the equipment and/or appliances are installed, who, upon request of the Using Service's representative, will honor the guarantee during the guaranty period and will provide the services prescribed by the terms of the guarantee.

15. PRICING OF CONTRACTOR-FURNISHED PROPERTY. At the request of the Contracting Officer, the Contractor shall promptly furnish and shall cause any subcontractors to furnish, in like manner, unit prices and descriptive data required by the Government for property record purposes of fixtures and equipment furnished and installed by the Contractor.

16. PROJECT ENGINEER'S OFFICE.

16.1 General. The Contractor shall provide a suitable 10' x 50' office trailer for the Project Engineer. The exact site will require the Contracting Officer's approval. The trailer shall be adequately heated, well lighted, suitably ventilated, and cooled with a properly sized refrigeration type air conditioning unit, complete, with all piping and electrical connections. An adequate supply of cooled drinking water, sewer, telephone, and electrical services shall be furnished and maintained. Open parking space for 6 vehicles and water and sanitary facilities shall be located convenient to the office. The combined parking and building area shall be enclosed with a woven wire fence approximately 6 feet high with a 10-foot wide lockable gate accessible from a road or street. The fenced area shall be of sufficient size to permit ease in the parking of vehicles. Materials for the facilities need not be new provided they are adequate for the intended use. The cost for sewer, water, power, and telephone usage will be the responsibility of the Contractor except that the Contractor will be reimbursed for any long distance telephone charges.

17. OPERATION AND MAINTENANCE MANUALS AND INSTRUCTIONS.

17.1 The requirements for furnishing operating and maintenance data/manuals and field instructions under this contract are specified in the Technical Provisions. The Contractor shall submit to the Contracting Officer, not later than 30 calendar days prior to the project completion time, an outline showing the proposed submittal data(s) of operation and maintenance manuals to be furnished to the Government and the scheduled Contractor furnished personnel or manufacturer's representatives. All operation and maintenance manuals must be furnished to the Contracting Officer not later than 30 calendar days prior to the scheduled dates of any required Contractor furnished field instructions or not later than 30 calendar days prior to project completion if no Contractor furnished field instructions are required.

17.2 Failure on the part of the Contractor to comply with requirements of this clause will result in the Government withholding an estimated amount for obtaining replacement (substituted) manuals from a different source or until all required O&M data/manuals are submitted and accepted.

17.2.1 All O&M data/manuals submittal data shall be entered in a separate section of the master submittal register.

-- End of Section --

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CONCRETE

SECTION 03450

PRECAST ARCHITECTURAL CONCRETE

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Precast Concrete Wall; GA.

Three 4'-0" x 4'-0" x 10 inch samples of precast unit finish required for the project. Samples shall show matrix color, surface color, surface texture and panel back finish. The samples shall be maintained at the job site untit approval by the Contracting Officer for removal or incoporating in the project. The mock-up shall be used to establish quality and acceptance of precast units to be used on the project and shall show the exterior finish (matrix color, surface color, surface texture and aggregate) panel back finish, edge treatment, joint treatment, reinforcement, anchorage insert, lifting inserts and other accessories.

Manufacturer's Qualifications; GA.

A statement giving the qualifications of the precast concrete manufacturer and of the installers, prior to commencing operations.

Inspection at the Site

Immediately prior to placement all precast concrete units shall be inspected for quality to insure all precast units conform to the requirements specified. Inspection for quality will include but not necessarily be limited to the following elements; color, texture, dimensional tolerances, chipping, cracking, staining, warping and honeycombing. All defective precast concrete units shall be replaced or repaired as approved.

1.5 DELETED

PART 2 PRODUCTS

2.1 MATERIALS

Except as otherwise specified, material shall conform to SECTION: CAST-IN-PLACE CONCRETE.

2.1.1 Aggregates

Aggregates for all exterior exposed architectural surfaces shall be natural crushed copper slag. The slag shall be cleaned of silt and organic impurities. It shall be a maximum size of 1-1/2 inch to a minimum of 1/2 inch with 80 percent of the aggregate used being larger than 1 inch. Evidence of the aggregate inertness, soundness and hardness shall be provided as information under SD-14, Samples - Copper Slag Aggregate of this section.

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
N/A	1 1

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
0004	24 NOV 92	N/A	Spec No: W93B0003

6. ISSUED BY CODE

U.S. ARMY ENGINEER DISTRICT, LOS ANGELES
P.O. Box 2711
Los Angeles, California 90053-2325

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.
DACW09-93-B-0003

9B. DATED (SEE ITEM 11)
15 DEC 92 (Bid Opening)

10A. MODIFICATION OF CONTRACT/ORDER NO.
N/A

10B. DATED (SEE ITEM 13)
N/A

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☒ is extended, ☐ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT 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.

(X) 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 AUTHORITY OF:

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.)

HEDGEPETH HILLS CULTURAL RESOURCES INTERPRETIVE CENTER, Maricopa County, Arizona

The Bid Opening Date is hereby Extended to 15 DEC 92.

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

CAUTION TO BIDDERS

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

1. AMENDMENTS: Have you acknowledged receipt of ALL Amendments? If in doubt as to the number of Amendments issued, please contact our office.

2. AMENDED BID PAGES: If any of the Amendments furnished amended bid pages, the amended bid pages must be used in submitting your bid.

3. LATE BIDS: In order for a late mailed bid to be considered, generally it must have been sent by either registered or certified mail not later than the fifth calendar day prior to the date specified for the receipt of bids.

4. BID GUARANTEE: Sufficient bid guarantee in proper form must be furnished with your bid for jobs exceeding $25,000.

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

6. TELEGRAPHIC MODIFICATIONS: If you modify your bid by telegram, be sure to allow sufficient time for the telegram to reach us prior to the time set for bid opening. Any doubt should be resolved in favor of allowing Extra Time. FAX transmittals for bids and bid modifications are not acceptable.

7. BID DOCUMENTS: Bidders are cautioned to complete and include at least the following documents in their bid:

   a. A Standard Form (SF) 1442 "Solicitation, Offer, and Award" with acknowledgment of amendments, if any;

   b. A completed bidding schedule (Section B);

   c. The section titled "Representations/Certifications (Section K) *(SPECIAL NOTE: Failure to complete and include the provision titled "Requirement for Certificate of Procurement Integrity" from this section will render the bid nonresponsive, thus ineligible for award.)*

   d. A bid bond (SF24); and

   e. Any other documents required by the solicitation.

8. EQUIPMENT REQUIRING AIR QUALITY PERMITS: A Contract will not be awarded to a successful bidder proposing to use equipment requiring an Air Quality Permit unless a copy of a current valid Air Quality Permit is furnished to the Government prior to contract award.

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SOLICITATION, OFFER AND AWARD (Construction, Alteration, or Repair)	1. SOLICITATION NO.	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF PAGES
	DACW09-93-B-0003	☒ SEALED BID (IFB) ☐ NEGOTIATED (RFP)	16 OCT 92	1 of 3

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

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

7. ISSUED BY CODE	8. ADDRESS OFFER TO
U.S. ARMY ENGINEER DISTRICT, LOS ANGELES P.O. Box 2711 Los Angeles, California 90053-2325	U.S. ARMY ENGINEER DISTRICT, LOS ANGELES Phoenix Office 3636 N. Central Avenue, Room 760 Phoenix, Arizona 85012-1936

9. FOR INFORMATION CALL:	A. NAME	B. TELEPHONE NO. (Include area code) (NO COLLECT CALLS)
	See "INSTRUCTIONS TO BIDDERS"	

SOLICITATION

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

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

HEDGPETH HILLS CULTURAL RESOURCES INTERPRETIVE CENTER (CRIC), Maricopa County, Arizona

The work consists of construction of a cultural interpretive center, including grading; excavation, trenching, and backfilling for utility systems; concrete pavement and steps; water lines and sanitary sewers; tilt-up concrete walls with exposed aggregate exterior face; structural steel work; carpentry; single-ply roof membrane with gravel balast on rigid insulation on acoustical metal decking; steel doors and frames, glass, and glazing; acoustical ceiling; carpet; painting; bathroom fixtures; general plumbing and air-conditioning system; electrical work; planting of trees, shrubs and wildflowers; irrigation system, decomposed granite paths and pavement and chain-link fencing.

The estimated cost of construction is between $1,000,000 and $5,000,000.

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

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

13. ADDITIONAL SOLICITATION REQUIREMENTS:

A. Sealed offers in original and no copies to perform the work required are due at the place specified in Item 8 by 1:00 PM (hour) local time 17 NOV 92 (date). If this is a sealed bid solicitation, offers must be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.

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

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

D. Offers providing less than 60 calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.

OFFER (Must be fully completed by offeror)

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

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

AMOUNTS ▶ In accordance with the attached BIDDING SCHEDULE.

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

19. ACKNOWLEDGMENT OF AMENDMENTS

(The offeror acknowledges receipt of amendments to the solicitation – give number and date of each)

AMENDMENT NO.										
DATE										

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

AWARD (To be completed by Government)

21. ITEMS ACCEPTED:

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA
24. SUBMIT INVOICES TO ADDRESS SHOWN IN (4 copies unless otherwise specified) ▶	ITEM
	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO ☐ 10 USC 2304(c)( ) ☐ 41 USC 253(c)( )
26. ADMINISTERED BY CODE	27. PAYMENT WILL BE MADE BY

CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

☐ 28. NEGOTIATED AGREEMENT (Contractor is required to sign this document and return _____ copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all work, requisitions identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications or incorporated by reference in or attached to this contract.

☐ 29. AWARD (Contractor is not required to sign this document.) Your offer on this solicitation, is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.

30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN (Tpye or print)		31A. NAME OF CONTRACTING OFFICER (Type or print)	
30B. SIGNATURE	30C. DATE	31B. UNITED STATES OF AMERICA BY	31C. AWARD DATE

STANDARD FORM 1442 BACK (REV. 4-85)

Continuation of Standard Form 1442

20D. (1) IF THE OFFEROR IS A JOINT VENTURER, COMPLETE THE FOLLOWING:

(Company Name)	(Signature)	(Title)
(Company Name)	(Signature)	(Title)
(Company Name)	(Signature)	(Title)

NOTE: If a Corporation is participating as a member of a Joint Venture, the Certificate as to Corporate Principal in item (3) below must also be completed and signed.

(2) IF THE OFFEROR IS A PARTNERSHIP, LIST FULL NAME OF ALL PARTNERS.

(Name)	(Signature)
(Name)	(Signature)
(Name)	(Signature)

(3) IF THE OFFEROR IS A CORPORATION, THE FOLLOWING CERTIFICATE SHOULD BE COMPLETED

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____ (name), certify that I am the _____ Secretary of the corporation named as offeror in the within offer; that _____ (name), who signed said offer on behalf of the corporation, was then _____ (title) of said corporation; that the signature thereto is genuine; and that said contract was duly signed, sealed and attested for and in behalf of said corporation by authority of its governing body.

_____
(Name of Corporation)

(Affix)
(CORPORATE SEAL)

_____
(Secretary)

SECTION 00010

BIDDING SCHEDULE

Item No.	Description	Quantity	Unit	Unit Price	Amount
1.	CULTURAL RESOURCES INTERPRETIVE CENTER (CRIC), HEDGPETH HILLS, MARICOPA COUNTY, ARIZONA	1	Job	L.S.	$_____
			TOTAL AMOUNT		$_____

NOTE: Bids shall be submitted on all items of the Bidding Schedule.

Amounts shall be indicated in either figures or words, not both.

-- End of Section --

SECTION 00100

INSTRUCTIONS TO BIDDERS

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SECTION 00100

INSTRUCTIONS TO BIDDERS

1. SOLICITATION DEFINITIONS--SEALED BIDDING (JUL 1987) FAR 52.214-1.

"Government" means United States Government.

"Offer" means "bid" in sealed bidding.

"Solicitation" means an invitation for bids in sealed bidding.

2. AMENDMENTS TO INVITATIONS TO BIDS (DEC 1989) FAR 52.214-3.

(a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.
(b) Bidders shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date in the space provided for this purpose on the form for submitting a bid, (3) by letter or telegram, or (4) by facsimile, if facsimile bids are authorized in the solicitation. The Government must receive the acknowledgment by the time and at the place specified for receipt of bids.

3. FALSE STATEMENT IN BIDS (APR 1984) FAR 52.214-4. Bidders must provide full, accurate, and complete information as required by this solicitation and its attachments. The penalty for making false statements in bids is prescribed in 18 U.S.C 1001.

4. SUBMISSION OF BIDS (DEC 1989) FAR 52.214-5.

(a) Bids and bid modifications shall be submitted in sealed envelopes or packages (unless submitted by electronic means) (1) addressed to the office specified in the solicitation and (2) showing the time specified for receipt, the solicitation number, and the name and address of the bidder.
(b) Telegraphic bids will not be considered unless authorized by the solicitation; however, bids may be modified or withdrawn by written or telegraphic notice.
(c) Facsimile bids, modifications, or withdrawals, will not be considered unless authorized in the solicitation.

5. DIRECTIONS FOR SUBMITTING BIDS.

5.1 Envelopes containing bids, guarantees, etc., must be sealed, marked, and addressed as follows:

Bid Under Reference No: DACW09-93-B-0003	To: U.S. ARMY ENGINEER DISTRICT, LOS ANGELES ATTN: Contracting Division 3636 North Central Avenue, Room 760 Phoenix, Arizona 85012-1936

5.2 Hand carried bids shall be deposited in Room 760, 3636 North Central Avenue, Phoenix, Arizona 85012-1936, prior to the time and date set for opening of bids.

5.3 Telegraphic Modifications to Bids should be addressed to:

U.S. Army Engineer District, Los Angeles
3636 North Central Avenue, Room 760
Phoenix, Arizona 85012-1936
Telephone Number: (602) 640-2018

5.4 Modifications to bids submitted by facsimile (telecopier) or teletype are not authorized and will not be considered.

6. EXPLANATION TO PROSPECTIVE BIDDERS (APR 1984) FAR 52.214-6. Any prospective bidder desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective bidders before the submission of their bids. Oral explanations or instructions given before the award of a contract will not be binding. Any information given a prospective bidder concerning a solicitation will be furnished promptly to all other prospective bidders as an amendment to the solicitation, if the information is necessary in submitting bids or if the lack of it would be prejudicial to other prospective bidders.

7. LATE SUBMISSIONS, MODIFICATIONS, AND WITHDRAWALS OF BIDS (DEC 1989) FAR 52.214-7.

(a) Any bid received at the office designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made and it:

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

(2) Was sent by mail, or if authorized by the solicitation, was sent by telegram or via facsimile, and it is determined by the Government that the late receipt was due solely to mishandling by the Government after receipt at the Government installation, or

(3) Was sent by U.S. Postal Service Express Mail Next Day Service-Post Office To Addressee, not later 5:00 P.M. at the place of mailing two working days prior to the date specified for receipt of bids. The term "working days" excludes weekends and U.S. Federal holidays.

(b) Any modification or withdrawal of a bid is subject to the same conditions as in paragraph (a) above.

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

(d) The only acceptable evidence to establish the time of receipt at the Government installation is the time/date stamp of that installation on the bid wrapper or other documentary evidence of receipt maintained by the installation.

(e) The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent by U.S. Postal Service Express Mail Next Day Service-Post Office To Addressee is the date entered by the post office receiving clerk on the "Express Mail Next Day Service-Post Office to Addressee" label and both the postmark on the envelope or wrapper and on the original receipt from the U.S. Postal Service. "Postmark" has the same meaning as defined in paragraph (c) of this provision, excluding postmarks of the Canadian Postal Service. Therefore, bidders should request the postal clerk to place a legible hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.
(f) Notwithstanding paragraph (a) of this provision, a late modification of an otherwise successful bid that makes its terms more favorable to the Government will be considered at any time it is received and may be accepted.
(g) Bids may be withdrawn by written notice or telegram (including mailgram) received at any time before the exact time set for receipt of bids. If the solicitation authorizes facsimile bids, bids may be withdrawn via facsimile received at any time before the exact time set for receipt of bids, subject to the conditions specified in the provision entitled "Facsimile Bids." A bid may be withdrawn in person by a bidder or its authorized representative if, before the exact time set for receipt of bids, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid.

8. PREPARATION OF BIDS-CONSTRUCTION (APR 1984) FAR 52.214-18.

(a) Bids must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a bid must initial each erasure or change appearing on any bid form.
(b) The bid form may require bidders to submit bid prices for one or more items on various bases, including:
(1) Lump sum bidding;
(2) Alternate prices;
(3) Units of construction; or
(4) Any combination of subparagraphs (1) through (3) above.
(c) If the solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, bidders should insert the words "no bid" in the space provided for any item on which no price is submitted.
(d) Alternate bids will not be considered unless this solicitation authorizes their submission.

9. CONTRACT AWARD-SEALED BIDDING-CONSTRUCTION (FEB 1986) FAR 52.214-19.

(a) The Government will evaluate bids in response to this solicitation without discussions and will award a contract resulting from this solicitation to the responsible bidder whose bid, conforming to the solicitation, will be most advantageous to the Government, considering only price and the price-related factors specified elsewhere in the solicitation.
(b) The Government may reject any or all bids, and waive informalities or minor irregularities in bids received.
(c) The Government may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation or the bid.

10. AVAILABILITY OF SPECIFICATIONS LISTED IN THE DOD INDEX OF SPECIFICATIONS AND STANDARDS (DODISS) (SEP 1990) FAR 52.210-2. Single copies of specifications cited in this solicitation may be obtained by submitting a written request to the supply point

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

Standardization Document
Order Desk, Building 4, Section D
700 Robbins Avenue
Philadelphia, PA 19111-5094
Telex Number.....834295
Western Union Number....710-670-1685
Telephone Number.....(215) 697-3321
(Express Shipment pickup)
Telephone Order Entry System (TOES) Number
.....(215-697-1187 through and including
215-697-1197)

11. AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS, STANDARDS, PLANS, DRAWINGS, DATA ITEM DESCRIPTIONS, AND OTHER PERTINENT DOCUMENTS (DEC 1991) DFARS 252.210-7002. The specification, standards, plans, drawings, descriptions, and other pertinent documents cited in this solicitation may be examined at the following locations:

Brunswig Square Building
Plan Room, Room 300
360 East Second Street
Los Angeles, California 90013

12. EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE. Whenever a contract or modification of contract price is negotiated, the Contractor's cost proposals for equipment ownership and operating expenses shall be determined in accordance with the requirements of paragraph: EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE contained in the SPECIAL CLAUSES. A copy of EP 1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" is available for review at Room 7216, 300 North Los Angeles Street, Los Angeles, California. Individual copies of EP 1110-1-8 are available from the Government Printing Office (GPO) for $13.00. To order the publication telephone (202) 783-3238.

13. SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING. Bidders are cautioned that failure to comply in good faith with the CONTRACT CLAUSES entitled (1) "Utilization of Small Business Concerns and Small Disadvantaged Business Concerns" and (2) "Small Business and Small Disadvantaged Business Subcontracting Plan (Alternate I)", when applicable, will be a material breach of contract. In order to assist prime contractors in developing a source list of Small and Small Disadvantaged Business Concerns, you are encouraged to contact minority Contractor associations, the Minority Business Development Agency, and the appropriate General Business Service Centers in your Standard Metropolitan Statistical Area, addresses of which may be obtained from:

Write: U.S. Army Engineer District, Los Angeles
ATTN: CESPL-DE-B
P.O. Box 2711
Los Angeles, California 90053-2325

Telephone: Mary Workman
Small and Disadvantaged Business Utilization Specialist
Area Code (213) 894-4920

14. ADDITIONAL INFORMATION pertaining to these plans and specifications may be obtained by writing or calling (collect calls not accepted) U.S. Army Engineer District, Los Angeles, Attn: Mr. G. E. Davis, P.O. Box 2711, Los Angeles, California 90053-2325. Telephone (213) 894-5493.

14.1 All inquiries after bid opening should be directed to: Mr. B. J. Meirowsky. Telephone (213) 894-5660. By mail: P.O. Box 2711, Los Angeles, California 90053-2325. In person: Brunswig Square Building, Room 308, 360 East Second Street, Los Angeles, California 90013.

14.2 Bid Results may be obtained by calling (213) 894-3638.

15. SITE INSPECTION. Arrangements for visiting the site may be made by contacting: Mr. Neil Erwin, Maricopa Civil Works Resident Office, U.S. Army Engineer District, Los Angeles, 9601 North 21st Drive, Phoenix, Arizona 85021, telephone (602) 379-3023. A tentative site inspection for bidders has been scheduled on 04 November 1992.

16. DRAWINGS. Specifications with half-size drawings will be furnished upon receipt of payment of $25.00 per set. Full-size drawings will be furnished upon receipt of payment of $50.00 per set. The maximum charge shall not exceed the charge for a full set of plans. No refund of the payment for drawings will be made and the drawings need not be returned to the District Engineer. Additional copies of the specifications alone will be furnished an applicant at the rate of $5.00 per copy. Payments will be made by check or money order and mailed to the U.S. Army Engineer District, Los Angeles, P.O. Box 711, Los Angeles, California 90053-2325. Checks and money orders should be made payable to "FAO, U.S. Army, Los Angeles District". Over the counter purchases of plans and specifications may be made at Brunswig Square Building, Room 300, 360 East Second Street, Los Angeles, California 90013.

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

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.
(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
30%	6.9%

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.
(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction", and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.
(d) The Contractor shall provide written notification to the Director, Office of Federal Contract Compliance Programs, within 10 working days following award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the:

(1) Name, address, and telephone number of the subcontractor;
(2) Employer's identification number of the subcontractor;
(3) Estimated dollar amount of the subcontract;
(4) Estimated starting and completion dates of the subcontract; and
(5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and any contract resulting from this solicitation, the "covered area" is Maricopa County.

18. BONDS.

18.1 Bid Guarantees. Each Bidder shall submit with his bid a Bid Bond (Standard Form 24) with good and sufficient surety or surities acceptable to the Government, or other security as provided in paragraph: BID GUARANTEE of the Contract Clauses, in the amount of at least twenty percent (20%) of the bid price but shall not exceed $3,000,000. The Bid Bond amount may be expressed in terms of a percentage of the bid price or may be expressed in dollars and cents. When the penal sum is expressed as a precentage, a maximum dollar limitation may be stated.

18.2 Performance and Payment Bonds. After the prescribed forms have been presented to the bidder to whom award is to be made for signature, two bonds, each with good and sufficient surety or sureties acceptable to the Government, shall be furnished; namely a Performance Bond (Standard Form 25) and a Payment Bond (Standard Form 25A). The penal sums of such bonds shall be as follows:

18.2.1 Performance Bond. The penal sum shall equal one hundred percent (100%) of the original contract price.

18.2.2 Payment Bond.

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

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

18.2.2.3 When the contract price is more than $5,000,000, the penal sum shall be $2,500,000.

18.3 The Contractor shall furnish all bonds before receiving a notice to proceed with the work or being allowed to start work.

NOTE: For contracts less than $25,000, Bid Bonds, and Performance and Payment Bonds are not required.

19. SERVICE OF PROTEST (NOV 1988) FAR 52.233-2.

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with General Accounting Office (GAO) or the General Services Administration Board of Contract Appeals (GSBCA), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from the Chief, Contracting Division, or his authorized representative, Brunswig Square Building, Room 308, 360 East Second Street, Los Angeles, California 90013.
(b) The copy of any protest shall be received in the office designated above on the same day a protest is filed with the GSBCA or within one day of filing a protest with the GAO.

20. INDIVIDUAL SURETIES IN SUPPORT OF BIDS. Offerors utilizing individual sureties in support of a bid bond shall include a Standard Form (SF) 28, Affidavit of Individual Surety, accompanied by a pledge of acceptable assets from each person acting as an individual surety, and include these with the SF 24, Bid Bond, and the bid itself in accordance with the paragraph entitled PLEDGES OF ASSETS of the Contract Clauses. Pledges of acceptable assets shall be in the form of (1) evidence of an escrow account, and/or (2) a recorded lien on real estate. Failure to provide pledges of acceptable assets, with the bid, in the specified form, accompanied by a properly executed SF 24 and SF 28, will render the offeror nonresponsible, thus ineligible for award.

21. BIDDER'S QUALIFICATION. Before a bid is considered for award, the bidder may be requested by the Government to submit a statement regarding his previous experience in performing comparable work, his business and technical organization, financial resources, and plant available to be used in performing the work.

22. PERFORMANCE EVALUATION OF CONTRACTOR.

22.1 As a minimum, the Contractor's performance will be evaluated upon final acceptance of the work. However, interim evaluation may be prepared at any time during contract performance when determined to be in the best interest of the Government.

22.2 The format for the evaluation will be SF 1420, and the Contractor will be rated either outstanding, satisfactory, 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 of any unsatisfactory rating, either in an individual element or in the overall rating,

prior to completing the evaluation, and all Contractor comments will be made a part of the official record. Performance evaluation reports will be available to all DOD Contracting Offices for their future use in determining Contractor responsibility, in compliance with DFARS 236.201(c)(1).

22.3 A similar evaluation for subcontractors will be prepared if the Government deems it to be appropriate.

23. SIC CODE AND SMALL BUSINESS SIZE STANDARD (JAN 1991) FAR 52.219-22.

(a) The standard industrial classification (SIC) code for this acquisition is 1542.
(b) (1) The small business size standard is $17,000,000.
(2) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

-- End of Section --

SECTION 00600

REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFEROR

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SECTION 00600

REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFEROR

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

(a) The Offeror certifies that--

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

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

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

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

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

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above

_____

[insert full name of person(s) in the Offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the Offeror's organization];

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

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

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

2. CONTINGENT FEE REPRESENTATION AND AGREEMENT (APR 1984) FAR 52.203-4.

(a) Representation. The Offeror represents that, except for full-time bona fide employees working solely for the Offeror, the Offeror--

[Note: The Offeror must check the appropriate boxes. For interpretation or the representation, including the term "bona fide employee," see Subpart 3.4 of the Federal Acquisition Regulation.]

(1) / / has, / / has not employed or retained any person or company to solicit or obtain this contract; and

(2) / / has, / / has not paid or agreed to pay to any person or company employed or retained to solicit or obtain this contract any commission, percentage, brokerage, or other fee contingent upon or resulting from the award of this contract.

(b) Agreement. The Offeror agrees to provide information relating to the above Representation as requested by the Contracting Officer and, when subparagraph (a)(1) or (a)(2) is answered affirmatively, to promptly submit to the Contracting Officer--

(1) A completed Standard Form 119, Statement of Contingent or Other Fees, (SF 119); or

(2) A signed statement indicating that the SF 119 was previously submitted to the same contracting office, including the date and applicable solicitation or contract number, and representing that the prior SF 119 applies to this offer or quotation.

3. TYPE OF BUSINESS ORGANIZATION (JUL 1987) FAR 52.215-6.

The offeror or quoter, by checking the applicable box, represents that--

(a) It operates as / / a corporation incorporated under the laws of the State of / / , / / an individual, / / a partnership, / / a nonprofit organization, or / / a joint venture.

(b) If the offeror or quoter is a foreign entity, it operates as / / an individual, a / / partnership, / / a nonprofit organization, or / / a joint venture.

4. SMALL BUSINESS CONCERN REPRESENTATION (JAN 1991) FAR 52.219-1.

(a) Representation. The Offeror represents and certifies as part of its offer that it ____ is, ____ is not a small business concern and that ____ , all, ____ not all end items to be furnished will be manufactured or produced by a small business concern in the United States, its territories or possessions, Puerto Rico, or the Trust Territory of the Pacific Islands.

(b) Definition. "Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria and size standards in this solicitation.

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

(1) be punished by imposition of a fine, imprisonment, or both;

(2) be subject to administrative remedies; and

(3) be ineligible for participation in programs conducted under the authority of the Act.

5. SMALL DISADVANTAGED BUSINESS CONCERN REPRESENTATION (DoD CONTRACTS) (DEC 1991) DFARS 252.219-7000.

(a) Definition. "Small disadvantaged business concern," as used in this provision, means a small business concern, owned and controlled by individuals who are both socially and economically disadvantaged, as defined by the Small Business Administration at 13 CFR Part 124, the majority of earnings of which directly accrue to such individuals. This term also means a small disadvantaged business concern

owned and controlled by an economically disadvantaged Indian Tribe or Native Hawaiian organization which meets the requirements of 13 CFR 124.112 or 13 CFR 124.113, respectively. In general, 13 CFR Part 124 describes a small disadvantaged business concern as a small business concern--

(1) Which is at least 51 percent unconditionally owned by one or more socially and economically disadvantaged individuals; or

(2) In the case of any publicly owned business, at least 51 percent of the voting stock is unconditionally owned by one or more socially and economically disadvantaged individuals; and

(3) Whose management and daily business operations are controlled by one or more such individuals.

(b) Representations. Check the category in which your ownership falls--

_____ Subcontinent Asian (Asian-Indian) American (U.S. citizen with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, or Nepal)

_____ Asian-Pacific American (U.S. citizen with origins from Japan, China, the Philippines, Vietnam, Korea, Samoa, Guam, U.S. Trust Territory of the Pacific Islands (Republic of Palau), the Northern Mariana Islands, Laos, Kampuchea (Cambodia), Taiwan, Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Republic of the Marshall Islands, or the Federated States of Micronesia)

_____ Black American (U.S. Citizen)

_____ Hispanic American (U.S. Citizen with origins from South America, Central America, Mexico, Cuba, the Dominican Republic, Puerto Rico, Spain, or Portugal)

_____ Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians, including Indian tribes or Native Hawaiian Organizations)

_____ Individual/concern, other than one of the preceeding, currently certified for participation in the Minority Small Business and Capital Ownership Development Program under Section 8(a) of the Small Business Act

_____ Other

(c) Certifications. Complete the following--

(1) The Offeror is _____ is not _____ a small disadvantaged business concern.

(2) The Small Business Administration (SBA) has _____ has not _____ made a determination concerning the offeror's status as a small disadvantaged business concern. If the SBA has made a determination, the date of the determination was _____ and the offeror--

_____ Was found by SBA to be socially and economically disadvantaged and no circumstances have changed to vary that determination.

_____ Was found by SBA not to be socially and economically disadvantaged but circumstances which caused the determination have changed.

(d) Notification. Notify the Contracting Officer before contract award if your status as a small disadvantaged business concern changes.

(e) Penalties and Remedies. Anyone who misrepresents the status of a concern as a small disadvantaged business for the purpose of securing a contract or subcontract shall--

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

(2) Be subject to administrative remedies, including suspension and disbarment; and

(3) Be ineligible for participation in programs conducted under the authority of the Small Business Act.

6. WOMEN-OWNED SMALL BUSINESS REPRESENTATION (APR 1984) FAR 52.219-3.

(a) Representation. The Offeror represents that it / / is, / / is not a women-owned small business concern.

(b) Definitions.

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

"Women-owned," as used in this provision, means a small business that is at least 51 percent owned by a woman or women who are U.S. citizens and who also control and operate the business.

7. CERTIFICATION OF NONSEGRATED FACILITIES (APR 1984) FAR 52.222-21.

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

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

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

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

(2) Retain the certifications in the files; and

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

NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS
FOR CERTIFICATIONS OF NON-SEGREGATED FACILITIES

A Certification of Nonsegregated Facilities must be submitted before the award of a subcontract under which the subcontractor will be subject to the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

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

The Offeror represents that--
(a) It / / has, / / has not participated in previous contract or subcontract subject either to the Equal Opportunity clause of this solicitation, the clause originally contained in Section 310 of Executive Order No. 10925, or the clause contained in Section 201 of Executive Order No. 11114;
(b) It / / has, / / has not, filed all required compliance reports; and
(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

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

The Offeror certifies that--
(a) Any facility to be used in the performance of this proposed contract is / / , is not / / listed on the Environmental Protection Agency List of Violating Facilities;
(b) The Offeror will immediately notify the Contracting Officer, before award, of the receipt of any communication from the Administrator, or a designee, of the Environmental Protection Agency, indicating that any facility that the Offeror proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and
(c) The Offeror will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

10. CONTRACTOR ESTABLISHMENT CODE (AUG 1989) FAR 52.204-4.

(a) In the block with its name and address, the Offeror should supply the Contractor Establishment Code applicable to that name and address, if known to the offeror. The number should be preceded by "CEC:". Offerors should take care to report the correct CEC and not a similar number assigned to the Offeror in a different system.
(b) The CEC is a 9-digit code assigned to a contractor establishment that contracts with a Federal executive agency. The CEC system is a contractor identification coding system which is currently the Dun and Bradstreet Data Universal Numbering System (DUNS). The CEC system is distinct from the Federal Taxpayer Identification Numbering (TIN) system.
(c) The Government will obtain a Contractor Establishment Code for any awardee that does not have or does not know its CEC.

11. PREFERENCE FOR LABOR SURPLUS AREA CONCERNS (APR 1984) FAR 52.220-1.

(a) This acquisition is not set aside for labor surplus area (LSA) concerns. However, the Offeror's status as such a concern may affect (1) entitlement to award in case of tie offers or (2) offer evaluation in accordance with the Buy American Act clause of this solicitation. In order to determine whether the Offeror is entitled to a preference under (1) or (2) above, the Offeror must identify, below, the LSA in which the costs to be incurred on account of manufacturing or production (by the Offeror or the first-tier subcontractors) amount to more than 50 percent of the contract price.

_____

_____

(b) Failure to identify the locations as specified above will preclude consideration of the Offeror as an LSA concern. If the Offeror is awarded a contract as an LSA concern and would not have otherwise qualified for award, the Offeror shall perform the contract or cause the contract to be performed in accordance with the obligations of an LSA concern.

12. ACQUISITION FROM SUBCONTRACTORS SUBJECT TO ON-SITE INSPECTION UNDER THE INTERMEDIATE-RANGE NUCLEAR FORCES (INF) TREATY (DEC 1991) DFARS 252.209-7000.

(a) The Contractor shall not deny consideration for a subcontract award under this contract to a potential subcontractor subject to on-site inspection under the INF Treaty, or a similar treaty, solely or in part because of the actual or potential presence of Soviet inspectors at the subcontractor's facility, unless the decision is approved by the Contracting Officer.
(b) The Contractor shall incorporate this clause, including this paragraph (b), in all solicitations and contracts over the dollar limitation in Section 13.000 of the Federal Acquisition Regulation, except those for commercial or commercial-type products.

13. TAXPAYER IDENTIFICATION (SEP 1989) FAR 52.204-3.

(a) Definitions.
"Common parent", as used in this solicitation provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.
"Corporate status", as used in this solicitation provision, means a designation as to whether the offeror is a corporate entity, an unincorporated entity (e.g., sole proprietorship or partnership), "Taxpayer Identification Number (TIN)", as used in this solicitation provision, means the number required by the IRS to be used by the offeror in reporting income tax and other returns.
(b) The offeror is required to submit the information required in paragraphs (c) through (e) of this solicitation provision in order to comply with reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M and implementing regulations issued by the Internal Revenue Service (IRS). If the resulting contract is subject to reporting requirements described in FAR 4.902(a), the failure or refusal by the Offeror to furnish the information may result in a 20 percent reduction of payments otherwise due under the contract.
(c) Taxpayer Identification Number (TIN).
( ) TIN: _____
( ) TIN has been applied for.
( ) TIN is not required because:
( ) Offeror is a nonresident alien, foreign corporation or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the U.S. and does not have an office or place of business or a fiscal paying agent in the U.S.;
( ) Offeror is an agency or instrumentality of a foreign govern ment;
( ) Offeror is an agency or instrumentality of Federal, state, or local government;
( ) Other. State Basis_____.
(d) Corporate Status.
( ) Corporation providing medical and health care services or engaged in the billing and collecting of payments for such services;

( ) Other corporate entity;
( ) Not a corporate entity;
( ) Sole proprietorship
( ) Partnership Hospital or extended care facility described in 26 CFR 501(c)(3) that is exempt from taxation under 26 CFR 501(a).

(e) Common Parent.

( ) Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

( ) Name and TIN of common parent:

( ) Name: _____

( ) Tin: _____

14. SMALL BUSINESS CONCERN REPRESENTATION FOR THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (JUL 1991) FAR 52.219-19.

(a) Definition.

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

(b) (Complete only if the Offeror has certified itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.)

The Offeror represents and certifies as part of its offer that it / / is, / / is not, an emerging small business.

(c) (Complete only if the Offeror is a small business or an emerging small business, indicating its size range.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees	Ave. Annual Gross Revenues
_____ 50 or fewer	_____ $1 Million or less
_____ 51 - 100	_____ $1,000,001 - $2 Million
_____ 101 - 250	_____ $2,000,001 - $3.5 Million
_____ 251 - 500	_____ $3,500,001 - $5 Million
_____ 501 - 750	_____ $5,000,001 - $10 Million
_____ 751 - 1,000	_____ $10,000,001 - $17 Million
_____ Over 1,000	_____ over $17 Million

15. CERTIFICATION REGARDING A DRUG-FREE WORKPLACE (JUL 1990) FAR 52.223-5.

(a) Definitions. As used in this provision:

"Controlled substance" means a controlled substance in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C. 812) and as further defined in regulation at 21 CFR 1308.11 - 1308.15.

"Conviction" means a finding of guilt (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes.

"Criminal drug statute" means a Federal or non-Federal criminal statute involving the manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Drug free workplace" means a site(s) for the performance of work done by the Contractor in connection with a specific contract at which employees of the Contractor are prohibited from engaging in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance.

"Employee" means an employee of a Contractor directly engaged in the performance of work under a Government contract. "Directly engaged" is defined to include all direct cost employees and any other Contractor employee who has other than a minimal impact or involvement in contract performance.

"Individual" means an offeror/Contractor that has no more than one employee including the offeror/Contractor.

(b) By submission of its offer, the offeror, if other than an individual, who is making an offer that equals or exceeds $25,000, certifies and agrees that, with respect to all employees of the offeror to be employed under a contract resulting from this solicitation, it will -- no later than thirty (30) calendar days after contract award (unless a longer period is agreed to in writing), for contracts of thirty (30) calendar days or more performance duration, or as soon as possible for contracts of less than thirty (30) calendar days performance duration; but in any case, by a date prior to when performance is expected to be completed--

(1) Publish a statement notifying such employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the Contractor's work-place and specifying the actions that will be taken against employees for violations of such prohibition;

(2) Establish an ongoing drug-free awareness program to inform such employees about--

(i) The dangers of drug abuse in the workplace;

(ii) The Contractor's policy of maintaining a drug-free workplace;

(iii) Any available drug counseling, rehabilitation, and employee assistance programs; and

(iv) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;

(3) Provide all employees engaged in performance of the contract with a copy of the statement required by subparagraph (b)(1) of this provision;

(4) Notify such employees in the statement required by subparagraph (b)(1) of this provision that, as a condition of continued employment on the contract resulting from this solicitation, the employee will--

(i) Abide by the terms of the statement; and

(ii) Notify the employer in writing of the employee's conviction under a criminal drug statute for a violation occurring in the workplace no later than five (5) calendar days after such conviction;

(5) Notify the Contacting Officer in writing within ten (10) calendar days after receiving notice under subdivision (b)(4)(ii) of this provision, from an employee or otherwise receiving actual notice of such conviction. The notice shall include the position title of the employee; and

(6) Within thirty (30) calendar days after receiving notice under subparagraph (b)(4)(ii) of this provision of a conviction take one of the following actions with respect to an employee who is convicted of a drug abuse violation occurring in the workplace:

(i) Take appropriate personnel action against such employee, up to and including termination; or

(ii) Require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by the Federal, State, or local health, law enforcement, or other appropriate agency.

(7) Make a good faith effort to maintain a drug-free workplace through implementation of subparagraphs (b)(1) through (b)(6) of this provision.

(c) By submission of its offer, the offeror, if an individual who is making an offer of any dollar value, certifies and agrees that the offeror will not engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in the performance of the contract resulting from this solicitation.

(d) Failure of the offeror to provide the certification required by paragraphs (b) or (c) of this provision, renders the offeror unqualified and ineligible for award. (See FAR 9.104-1(g) and (e) In addition to other remedies available to the Government, the certification in paragraphs (b) or (c) of this provision concerns a matter within the jurisdiction of an agency of the United States and the making of false, fictitious, or fraudulent certification may render the maker subject to prosecution under Title 18, United States Code, Section 1001.

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

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

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

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

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

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

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

17. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (MAY 1989) FAR 52.209-5.

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

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

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

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

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

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

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

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

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.
(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

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

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this certification.
(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989,--

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

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a

Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

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

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

19. HAZARDOUS MATERIAL IDENTIFICATION AND MATERIAL SAFETY DATA-ALTERNATE I (NOV 1991) FAR 52.223-3.

(a) "Hazardous material", as used in this clause, includes any material defined as hazardous under the latest version of Federal Standard No. 313 (including revisions adopted during the term of the contract).

(b) The offeror must list any hazardous material, as defined in paragraph (a) of this clause, to be delivered under this contract. The hazardous material shall be properly identified and include any applicable identification number, such as National Stock Number or Special Item Number. This information shall also be included on the Material Safety Data Sheet submitted under this contract.

Material (If none, insert "None")	Identification No.
_____	_____
_____	_____
_____	_____

(c) The apparently successful offeror, by acceptance of the contract, certifies that the list in paragraph (b) of this clause is complete. This list must be updated during performance of the contract whenever the Contractor determines that any other material to be delivered under this contract is hazardous.

(d) The apparently successful offeror agrees to submit, for each item as required prior to award, a Material Safety Data Sheet, meeting the requirements of 29 CFR 1910.1200(g) and the latest version Federal Standard No. 313, for all hazardous material identified in paragraph (b) of this clause. Data shall be submitted in accordance with Federal Standard No. 313, whether or not the apparently successful offeror is the actual manufacturer of these items. Failure to submit the Material Safety Data Sheet prior to award may result in the apparently successful offeror being considered nonreponsible and ineligible for award.

(e) If, after award, there is a change in the composition of the item(s) or a revision to Federal Standard No. 313, which renders incomplete or inaccurate the data submitted under paragraph (d) of this clause or the certification submitted under paragraph (c) of this clause, the Contractor shall promptly notify the Contracting Officer and resubmit the data.

(f) Neither the requirements of this clause nor any act or failure to act by the Government shall relieve the Contractor of any responsibility or liability for the safety of Government, Contractor, or subcontractor personnel or property.
(g) Nothing contained in this clause shall relive the Contractor from complying with applicable Federal, State, and local laws, codes, ordinances, and regulations (including the obtaining of licenses and permits) in connection with hazardous material.
(h) The Government's rights in the data furnished under this contract with respect to hazardous material are as follows:

(1) To use, duplicate, and disclose any data to which this clause is applicable. The purposes of this right are to--

(i) Apprise personnel of the hazardous to which they may be exposed in using, handling, packaging, transporting, or disposing of hazardous materials;

(ii) Obtain medical treatment for those affected by the material; and

(iii) Have others use, duplicate, and disclose the data for the Government for these purposes.

(2) To use, duplicate, and disclose data furnished under this clause, in accordance with subparagraph (h)(1) of this clause, in precedence over any other clause of this contract providing for rights in data.

(3) The Government is not precluded from using similar or identical data acquired from other sources.

(i) Except as provided in paragraph (i)(2), the Contractor shall prepare and submit a sufficient number of Material Safety Data Sheets (MSDS's), meeting the requirements of 29 CFR 19190.1200(g) and the latest version of Federal Standard No. 313, for all hazardous materials identified in paragraph (b) of this clause.

(1) For items shipped to consignees, the Contractor shall include a copy of the MSDS's with the packing list or other suitable shipping document which accompanies each shipment. Alternatively, the Contractor is permitted to mail MSDS's to consignees in advance of receipt of shipments by consignees, if authorized in writing by the Contracting Officer.

(2) For items shipped to consignees identified by mailing address as agency depots, distribution centers or customer supply centers, the Contractor shall provide one copy of the MSDS's in or on each shipping container. If affixed to the outside of each container, the MSDS's must be placed in a weather resistant envelope.

20. REQUIREMENT FOR CERTIFICATE OF PROCUREMENT INTEGRITY (NOV 1990) FAR 52.203-8.

(a) Definitions. The definitions at FAR 3.104-4 are hereby incorporated in this provision.
(b) Certifications. As required in paragraph (c) of this provision, the officer or employee responsible for this offer shall execute the following certification:

NOTE: THE CERTIFICATE IS ATTACHED AT THE END OF THIS SECTION.

(c)(1) For procurement using sealed bidding procedures, the signed certifications shall be submitted by each bidder with the bid submission except for procurements using two-step sealed bidding procedures (see Subpart 14.5). For those procurements, the certifications shall be submitted with submission of the step two sealed bids. A certificate is not required for indefinite delivery contracts (see Subpart 16.5) unless the total estimated value of all orders eventually to be placed under the contract is expected to exceed $100,000.

(2) For contracts and contract modifications which include options, a certificate is required when the aggregate value of the contract or contract modification and all options (see FAR 3.104-4(e)) exceeds $100,000.

(3) Failure of a bidder to submit the signed certificate with its bid shall render the bid nonresponsive.

(d) Pursuant to FAR 3.104-9(d), the Offeror may be requested to execute additional certificates at the request of the Government. Failure of the Offeror to submit the additional certificates shall cause its offer to be rejected.

(e) A certification containing a disclosure of a violation or possible violation will not necessarily result in the withholding of award under this solicitation. However, the Government, after evaluation of the disclosure, may cancel this procurement or take any other appropriate actions in the interests of the Government, such as disqualification of the Offeror.

(f) In making the certification in paragraph (2) of the certificate, the officer or employee of the competing contractor responsible for the offer may rely upon a one-time certification from each individual required to submit a certification to the competing contractor, supplemented by periodic training. These certifications shall be obtained at the earliest possible date after an individual required to certify begins employment or association with the Contractor. If a Contractor decides to rely on a certification executed prior to the suspension of section 27 (i.e., prior to December 1, 1989), the Contractor shall ensure that an individual who has so certified is notified that section 27 has been reinstated. These certifications shall be maintained by the Contractor for 6 years from the date a certifying employee's employment with the company ends or, for an agent, representative, or consultant, 6 years from the date such individual ceases to act on behalf of the Contractor.

(g) Certifications under paragraphs (b) and (d) of this provision are material representations of fact upon which reliance will be placed in awarding a contract.

-- End of Section --

CERTIFICATE OF PROCUREMENT INTEGRITY

(1) I, _____[Name of Certifier], am the officer or employee responsible for the preparation of this offer and hereby certify that, to the best of my knowledge and belief, with the exception of any information described in this certificate, I have no information concerning a violation or possible violation of subsection 27(a), (b), (d), or (f) of the Office of Federal Procurement Policy Act, as amended* (41 U.S.C. 423), (hereinafter referred to as "the Act"), as implemented in the FAR, occur ring during the conduct of this procurement (solicitation number).

(2) As required by subsection 27(e)(1)(B) of the Act, I further certify that, to the best of my knowledge and belief, each officer, employee, agent, representative, and consultant of _____ [Name of Offeror] who has participated personally and substantially in the preparation or submission of this offer has certified that he or she is familiar with, and will comply with, the requirements of subsection 27(a) of the Act, as implemented in the FAR, and will report immediately to me any information concerning a violation or possible violation of the Act, as implemented in the FAR, pertaining to this procurement.

(3) Violations or possible violations. (Continue on plain bond paper if necessary and label Certificate of Procurement Integrity (Continuation Sheet), ENTER NONE IF NONE EXIST) _____

_____

_____

(4) I agree that, if awarded a contract under this solicitation, the certification required by subsection 27(e)(1)(B) of the Act shall be maintained in accordance with paragraph (f) of this provision.

_____

[Signature of the officer or employee responsible for the offer and date]

_____

[Typed name of the officer or employee responsible for the offer]

* Subsections 27(a), (b), and (d) are effective on December 1, 1990. Subsection 27(f) is effective on June 1, 1991.

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

(End of certification)

SECTION 00700

INDEX OF CONTRACT CLAUSES

CLAUSES INCORPORATED BY REFERENCE - Alternate I (JUN 1988) FAR 52.252-2.

This contract incorporates the following clauses (listed on Pages 00700-2 through 00700-6) by reference, with the same force and effect as if they were given in full text. Upon request, The Contracting Officer will make their full text available.

I. FEDERAL ACQUISTION REGULATIONS (48 CFR CHAPTER 1) CLAUSES.

II. ENGINEER FEDERAL ACQUISITION REGULATION SUPPLEMENT (EFARS) CLAUSES.

III. DEPARTMENT OF DEFENSE FAR SUPPLEMENT (DFARS) (48 CFR CHAPTER 2) CLAUSES.

(End of Clause)

The full text of the following clauses may be obtained from Contracting Division, P.O. Box 2711, Los Angeles, California, 90053-2325, or, in person, at Brunswig Square Building, 360 East Second Street, Room 300, Los Angeles, California, 90013.

I.21	52.219-8	UTILIZATION OF SMALL BUSINESS CONCERNS AND SMALL DISADVANTAGED BUSINESS CONCERNS
22	52.219-9	SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING PLAN
I.23	52.219-9 I	SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING PLAN--ALTERNATE I
I.24	52.219-13	UTILIZATION OF WOMEN-OWNED SMALL BUSINESSES
I.25	52.219-14	LIMITATIONS ON SUBCONTRACTING
I.26	52.219-7000	SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING PLAN (DOD CONTRACTS)
I.27	52.219-7015	SMALL BUSINESS AND SMALL DISADVANTAGED BUSINESS SUBCONTRACTING PLAN (DEFENSE FAR SUPPLEMENT DEVIATION)
I.28	52.220-3	UTILIZATION OF LABOR SURPLUS AREA CONCERNS
I.29	52.220-4	LABOR SURPLUS AREA SUBCONTRACTING PROGRAM
I.30	52.222-1	NOTICE TO THE GOVERNMENT OF LABOR DISPUTES
I.31	52.222-3	CONVICT LABOR
I.32	52.222-4	CONTRACT WORK HOURS AND SAFETY STANDARDS ACT--OVERTIME COMPENSATION
I.33	52.222-6	DAVIS-BACON ACT
I.34	52.222-7	WITHHOLDING OF FUNDS
I.35	52.222-8	PAYROLLS AND BASIC RECORDS
I.36	52.222-9	APPRENTICES AND TRAINEES
I.37	52.222-10	COMPLIANCE WITH COPELAND ACT REQUIREMENTS
I.38	52.222-11	SUBCONTRACTS (LABOR STANDARDS)
I.39	52.222-12	CONTRACT TERMINATION-DEBARMENT
I.40	52.222-13	COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS
I.41	52.222-14	DISPUTES CONCERNING LABOR STANDARDS
I.42	52.222-15	CERTIFICATION OF ELIGIBILITY
I.43	52.222-26	EQUAL OPPORTUNITY
I.44	52.222-27	AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR CONSTRUCTION

I.71	52.236-3	SITE INVESTIGATION AND CONDITIONS AFFECTING THE WORK
I.72	52.236-5	MATERIAL AND WORKMANSHIP
I.73	52.236-6	SUPERINTENDENCE BY THE CONTRACTOR
I.74	52.236-7	PERMITS AND RESPONSIBILITIES
I.75	52.236-8	OTHER CONTRACTS
I.76	52.236-9	PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS
I.77	52.236-10	OPERATIONS AND STORAGE AREAS
I.78	52.236-11	USE AND POSSESSION PRIOR TO COMPLETION
I.79	52.236-12	CLEANING UP
I.80	52.236.13 I	ACCIDENT PREVENTION--ALTERNATE I
I.81	52.236-15	SCHEDULE FOR CONSTRUCTION CONTRACTS
I.82	52.236-17	LAYOUT OF WORK
I.83	52.236-21	SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION
I.84		FUEL PRICE ADJUSTMENT (1991 JAN HQ USACE) (EFARS 52.236-10001)
I.85	52.236-7000	COMPOSITION OF CONTRACTOR
I.86	52.236-7001	MODIFICATION OF PROPOSALS - PRICE BREAKDOWN
I.87	52.236-7004	CONTRACT PRICES - BIDDING SCHEDULES
I.88	52.242-13	BANKRUPTCY
I.89	52.243-5	CHANGES
I.90	52.243-7001	PRICING OF ADJUSTMENTS
I.91	52.244-1	SUBCONTRACTS (FIXED-PRICE CONTRACTS)
I.92	52.245-2	GOVERNMENT PROPERTY (FIXED-PRICE CONTRACTS)
I.93	52.245-4	GOVERNMENT-FURNISHED PROPERTY (SHORT FORM)
I.94	52.246-12	INSPECTION OF CONSTRUCTION
I.95	52.247-7203	TRANSPORTATION OF SUPPLIES BY SEA
I.96	52.247-7204	NOTIFICATION OF TRANSPORTATION OF SUPPLIES BY SEA
I.97	52.248-3 I	VALUE ENGINEERING--CONSTRUCTION--ALTERNATE I

General Decision Number AZ910001

Superseded General Decision No. AZ900001

State: Arizona

Construction Type:
Building

County(ies):
MARICOPA

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
1	03/15/1991
2	05/24/1991
3	11/15/1991
4	12/13/1991
5	10/02/1992

GROUP 1: A-frame boom truck, winch truck, air compressor, Beltcrete, boring bridge and texture, concrete mixer (skip type), conductor, brakeman, handler, conveyor, cross timing and pipe float, curing machine, dinky (under 20 tons), elevator hoist (Husky and similar), firemen (all), forklift and Ross carrier, generator (all), highline cableway signalman, hydrographic mulcher, hydrographic seeder, joint inserter, jumbo finishing machine, Kolman belt loader, machine conveyor, multiple power concrete saw, oiler, pavement breaker, power grizzly, power sweeper, pressure grout machine, pump, roller (except as otherwise classified), self-propelled chip spreading machine, skiploader (3.5 cu. yd. and less), slurry seal machine (Moto paver driver), small self-propelled compactor (with blade) - backfill, ditch operation, straw blower, tractor (D-5 and under), tripper, tugger, welding machine, wheel-type tractor (Ford, Ferguson type with attachments, Bee Gee etc.)

GROUP 2: Aggregate plant (including crushing, screening and sand plants, etc.), asphalt plant mixer, asphalt laydown machine, backhoe (rubber tired or track, less than 1 cu. yd. MRC), boring machine, concrete batch plant (all types and sizes), concrete mechanical tamping, spreading or finishing machine (including Clary, Johnson or similar types), concrete mixer (paving type and mobile mixers), concrete pump, crane (crawler and pneumatic less than 15 ton capacity MRC), drilling machine (including water wells), elevating grader (all types and sizes except as otherwise classified), field equipment serviceman, grade checker (excluding civil engineer), paver and similar type equipment, motor grader (any type power blade - rough), oiler driver, operating engineer rigger, pneumatic tired scraper (all sizes and types), power jumbo form setter, road oil mixing machine, roller (on all types asphalt pavement), screed, self-propelled compactor (with blade, 815, 825 or equivalent - grade operation), skip loader (all types with a rated capacity over 3.5 but less than 6 cu. yd.), slip form (power driven lifting device for concrete forms), soil cement road mixing machine (single pass type), heater and planer, tractor (dozer, pusher - all), traveling pipe-wrapping machine, trenching machine, tugger (two or more)

GROUP 3: Asphalt or concrete planing, rotomill and milling machine, auto grade machine (CMI and similar equipment), boring machine (including mole, badger and similar type), concrete pump (truck mounted with boom), crane (crawler and pneumatic over 15 tons but less than 100 tons capacity MRC), crawler type tractor with boom attachment and slope bar, derrick, Gradall, heavy duty mechanic/welder, helicopter hoist operator or pilot, highline cableway, mass excavator (150 Bucyrus, Erie and similar type), mechanical hoist (two or more drums), motor grader (any type power blade - finish), mucking machine, overhead crane, piledriver engineer (portable, stationary or skid rig), power driven ditch lining or ditch trimming machine, remote control earth moving machine, skip loader (all types with rated capacity 6 cu. yd. but less than 10 cu. yd.), slip form paving machine (including Gunnert, Zimmerman and similar types), tower crane or

* SFAZ0669A 04/01/1992

	Rates	Fringes
SPRINKLER FITTERS	19.85	5.58

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* SHEE0359A 01/01/1991

	Rates	Fringes
SHEET METAL WORKERS:		
Zone 1	17.55	3%+4.19
Zone 2	18.80	3%+4.19
Zone 3	21.55	3%+4.19

ZONE DEFINITIONS:

Zone 1: 0 to 35 miles from the city hall or city administration building in Flagstaff, Kingman, Prescott, Lake Havasau City, and Yuma; and from the intersection of Central and Washington in Phoenix
Zone 2: 35 to 65 miles from the cities listed above
Zone 3: Over 65 miles from the cities listed above

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* SUAZ1003A 11/05/1991

	Rates	Fringes
BRICKLAYERS	11.50	3.04
ELECTRICIANS	12.18	1.32
INSULATION INSTALLER	8.57	
LABORERS	7.55	
LANDSCAPE SPRINKLER INSTALLER	6.65	
LANDSCAPE LABORER	4.59	
PLASTERERS	15.69	3.06
ROOFERS	10.84	2.11
SOFT FLOOR LAYERS	12.46	.92
TILE, MARBLE & TERRAZZO WORKERS	13.74	2.76
TILE FINISHERS	11.77	1.79

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* TEAM0104A 06/01/1990

	Rates	Fringes
TRUCK DRIVERS:		
GROUP 1	7.62	2.87
GROUP 2	10.82	2.87
GROUP 3	15.26	2.87

TRUCK DRIVERS CLASSIFICATION DEFINITIONS:

GROUP 1: Pickup Driver, Station Wagon Driver, Man Haul Driver,

SECTION 00800

SPECIAL CLAUSES

Index

1. COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK 00800-1

2. LIQUIDATED DAMAGES-CONSTRUCTION 00800-1

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8. PERFORMANCE OF WORK BY THE CONTRACTOR 00800-3

9. TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER 00800-4

10. ORDER OF PRECEDENCE-SEALED BIDDING 00800-4

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-- End of Table of Contents --

SECTION 00800

SPECIAL CLAUSES

1. COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (1984 APR) FAR 52.212-3.

The Contractor shall be required to (a) commence work under this contract within 5 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 270 calendar days after the date of receipt of Notice to Proceed, except for seeding and planting. Seeding and planting shall be completed as soon as practicable and within the time limits stated in the Technical Provisions or as directed by the Contracting Officer. The time stated for completion shall include final cleanup of the premises.

2. LIQUIDATED DAMAGES-CONSTRUCTION (APR 1984) FAR 52.212-5.

(a) If the Contractor fails to complete the work within the time specified in the contract, or any extensions, the Contractor shall pay to the Government as liquidated damages, the sum of $750.00 for each day of delay.
(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.

3. CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS (DEC 1991) DFARS 252.236-7001.

(a) The Government--
(1) Will provide the Contractor, without charge ten sets of large-scale contract drawings and specifications except publications incorporated into the technical provisions by reference;
(2) Will furnish additional sets on request at the cost of reproduction; and
(3) May at its option, furnish the Contractor one set of reproducibles, or half-size drawings, in lieu of the drawings in paragraph (a)(1) of this clause.
(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 misdescription of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work, but shall be performed as if fully and correctly set forth and described in the drawings and specifications.

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

Title	File and Drawing No.
CRIC, Title Sheet	2521100, Sht. 1

4. PHYSICAL DATA (APR 1984) FAR 52.236-4. Data and Information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
(a) The indications of physical conditions on the drawings and in the specifications are the result of site investigations by surveys and core borings.
(b) Weather Conditions. The Contractor shall satisfy himself as to the hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from any U.S. Weather Bureau Office.
(c) Transportation Facilities. The Contractor shall make his own investigation of the condition of available public and private roads, railroads, and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress at the site work. It shall be the Contractor's responsibility to construct and maintain at his own expense, any haul roads required for construction operations.
(d) Additional Information, including but not necessarily limited to, results of laboratory tests of material encountered in test holes or other explorations and field logs, is available for inspection and study in the office of District Engineer, Geotechnical Branch, 300 N. Los Angeles Street, Los Angeles, California.

5. LAYOUT OF WORK (APR 1984) FAR 52.236-17. The Contractor shall lay out its work from the Government-established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

6. QUANTITY SURVEYS (APR 1984) FAR ALT I 52.236-16.

(a) Quantity surveys shall be conducted, and the data derived from these surveys shall be used in computing the quantities of work performed and the actual construction completed and in place.
(b) The Contractor shall conduct the original and final surveys and surveys for any periods for which progress payments are requested. All these surveys shall be conducted under the direction of a representative of the Contracting Officer, unless the Contracting Officer waives this requirement in a specific instance. The Government shall make such computations as are necessary to determine the quantities of work performed or finally in place. The Contractor shall make the computations based on the surveys for any periods for which progress payments are requested.

(c) Promptly upon completing a survey, the Contractor shall furnish the originals of all field notes and all other records relating to the survey or to the layout of the work to the Contracting Officer, who shall use them as necessary to determine the amount of progress payments. The Contractor shall retain copies of all such material furnished to the Contracting Officer.

7. EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE (1989 JUL) EFARS 31.105.

(a) 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 when the Government can determine both ownership and operating costs for each piece of equipment or equipment groups of similar serial and series from the Contractor's accounting records. When both ownership and operating costs cannot be determined from the Contractor's accounting records, equipment costs shall be based upon the applicable provisions of EP 1110-1-8, "Construction Equipment Ownership and Operating Expense Schedule," Region VII. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the Contracting Officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retrospective pricing, the schedule in effect at the time the work was performed shall apply. For retrospective pricing, the schedule in effect at the time the work was performed shall apply.
(b) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36 substantiated by certified copies of paid invoices. Rates for equipment rented from an organization under common control, lease-purchase or sale-leaseback arrangements will be determined using the schedule except that rental costs leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees are allowable. Costs for major repairs and overhaul are unallowable.
(c) When actual equipment costs are proposed and the total amount of the pricing action is over $25,000, cost or pricing data shall be submitted on Standard Form 1411, "Contract Pricing Proposal Cover Sheet." By submitting cost or pricing data, the Contractor grants to the Contracting Officer or an authorizing representative the right to examine those books, records, documents and other supporting data that will permit evaluation of the proposed equipment costs. After price agreement the Contractor shall certify that the equipment costs or pricing data submitted are accurate, complete and current.
(d) This does not apply to terminations. See 49.113(100) and FAR Part 49.

8. PERFORMANCE OF WORK BY THE CONTRACTOR (1984 APR) FAR 52.236-1. The Contractor shall perform on the site, and with its own organization, work equivalent to at least thirty-five (35%) percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement of this contract if, during the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

9. TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (ER 415-1-15, 31 Oct 89).

9.1 This provision specifies the procedure for 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:

(a) The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipation for the project location during any given month.
(b) The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

9.2 The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

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

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
7	4	2	1	0	2	4	4	2	2	2	6

9.3 Upon acknowledgement 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 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 subparagraph 9.2, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the Contract Clause entitled: DEFAULT (FIXED PRICE CONSTRUCTION).

10. ORDER OF PRECEDENCE-SEALED BIDDING (JAN 1986) FAR 52.214-29. Any inconsistence this solicitation or contract shall be resolved by giving precedence in the follow order: (a) the schedule (excluding the specification); (b) representations and instructions; (c) contract clauses; (d) other documents, exhibits, and attachments (e) the specifications.

11. AS-BUILT DRAWINGS (30 Jul 1986) ER 415-345-38.

11.1 General. The Contractor shall furnish 3 full size sets of as-built blueline prints for use in preparation of as-built drawings by the Government. The as-built prints shall be a record of the construction as installed and completed by the Contractor. They shall include all the information shown on the contract set of drawings and a record of all deviations, modifications, or changes from those drawings, however minor, which were incorporated in the work, all additional work not appearing on the contract drawings, and all changes which are made after final

inspection of the contract work. In event the Contractor accomplishes additional work which changes the as-built conditions of the facility after submission of the as-built drawings, the Contractor shall furnish revised and/or additional drawings as required to depict as-built conditions. The requirements for these additional drawings will be the same as for the as-built drawings included in the original submission. The prints shall show the following information, but not be limited thereto:

(a) The location and description of any utility lines or other installations of any kind or description known to exist within the construction area. The location includes dimensions to permanent features.

(b) The location and dimensions of any changes within the building or structure.

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

(d) Correct elevations if changes were made in site grading.

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

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

(g) All changes or modifications which result from the final inspection.

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

11.3 Submittal to Contracting Officer for review and approval. Not later than 2 weeks after acceptance of the project by the Government, the Contractor shall deliver to the Contracting Officer 3 full size sets of blueline prints marked up to depict as-built conditions. If upon review, the drawings are found to contain errors and/or omissions, they shall be returned to the Contractor for corrections. The Contractor shall complete the corrections and return the drawings to the Contracting Officer within ten (10) calendar days.

11.4 Preliminary As-Built Prints. The Contractor shall maintain one set of paper prints to show the as-built conditions. These as-built marked prints shall be kept current and available on the jobsite at all times. All changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. The as-built marked prints shall be jointly impacted for accuracy and completeness by the Contracting Officer's representative and responsible representative of the construction Contractor prior to submission of each monthly pay estimate. Information to be included on the preliminary prints shall conform to the requirements of final as-built prints.

-- End of Section --

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GENERAL REQUIREMENTS

SECTION 01090

SOURCES FOR REFERENCE PUBLICATIONS

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PART 3 EXECUTION (Not Applicable)

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SECTION 01090

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Reference publications are cited in other sections of the specifications along with identification of their sponsoring organizations. The addresses of the sponsoring organizations are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

AGRICULTURAL MARKETING SERVICE (AMS)
Seed Regulatory and Testing Branch
USDA, AMS, LS Div.
Bldg. 506, BARC-East
Soil Conservation Rd.
Beltsville, MD 20705

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)
1501 Wilson Blvd., 6th Floor
Arlington, VA 22209-2403
Ph: 703-524-8800
Fax: 703-528-3816

AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)
1513 Sixteenth St.
Washington, DC 20036
Ph: 202-483-9370

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)
30 W. University Dr.
Arlington Heights, IL 60004
Ph: 708-394-0150
Fax: 708-253-0088

AMERICAN ASSOCIATION OF NURSERYMEN (AAN)
1250 I St., NW, Suite 500
Washington, DC 20005
Ph: 202-789-2900

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)
P.O. Box 12215
Research Triangle Park, NC 27709
Ph: 919-549-8141
Fax: 919-549-8933

AMERICAN CONCRETE INSTITUTE (ACI)
P.O. Box 19150
Detroit, MI 48219-0150
Ph: 313-532-2600
Fax: 313-538-0655

AMERICAN HARDBOARD ASSOCIATION (AHA)
520 N. Hicks Rd.
Palatine, IL 60067
Ph: 312-934-8800

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
One E. Wacker Dr., Suite 3100
Chicago, IL 60601-2001
Ph: 312-670-2400
Fax: 312-670-5403

AMERICAN IRON AND STEEL INSTITUTE (AISI)
1133 Fifteenth St., NW, Suite 300
Washington, DC 20005
Ph: 202-452-7100
Fax: 202-463-6573

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
11 West 42nd St
New York, NY 10036
Ph: 212-642-4900
Fax: 212-302-1286

AMERICAN PLYWOOD ASSOCIATION (APA)
P.O. Box 11700
Tacoma, WA 98411-0700
Ph: 206-565-6600
Fax: 206-565-7265

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)
4153 Arlingate Plaza
Columbus, OH 43228-0518
Ph: 800-222-2768
Fax: 614-274-6899

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1916 Race St.
Philadelphia, PA 19103
Ph: 215-299-5585
Fax: 215-977-9679

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
1791 Tullie Cir., NE
Atlanta, GA 30329
Ph: 404-636-8400
Fax: 404-321-5478

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
22 Law Dr., Box 2300
Fairfield, NJ 07007-2300
Ph: 800-843-2763
Fax: 201-882-1717

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
P.O. Box 40362
Bay Village, OH 44140
Ph: 216-835-3040
Fax: 216-835-3488

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy
Denver, CO 80235
Ph: 303-794-7711
Fax: 303-794-7310

AMERICAN WELDING SOCIETY (AWS)
P.O. Box 351040
Miami, FL 33135
Ph: 800-443-9353
Fax: 305-443-7559

ARCHITECTURAL WOODWORK INSTITUTE (AWI)
P.O. Box 1550
Centreville, VA 22020
Ph: 703-222-1100
Fax: 703-222-2499

ASSOCIATED AIR BALANCE COUNCIL (AABC)
1518 K St., NW
Washington, DC 20005
Ph: 202-737-0202
Fax: 202-638-4833

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)
335 Lexington Ave.
New York, NY 10017
Ph: 212-661-4261

CARPET AND RUG INSTITUTE (CRI)
310 Holiday Ave.
P.O. Box 2048
Dalton, GA 30722-2048
Ph: 404-278-3176

CAST IRON SOIL PIPE INSTITUTE (CISPI)
5959 Shallowford Rd., Suite 419
Chattanooga, TN 37421
Ph: 615-892-0137
Fax: 615-892-0817

CEILINGS & INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION (CISCA)
104 Wilmot Rd., Suite 201
Deerfield, IL 60015-5195
Ph: 708-940-8800
Fax: 708-940-7218

CHLORINE INSTITUTE (CI)
2001 L St., NW
Washington, DC 20036
Ph: 202-775-2790
Fax: 202-223-7225

COMMERCIAL ITEM DESCRIPTIONS (CID)
Order from:
Standardization Documents Order Desk
Bldg 4D
700 Robbins Av
Philadelphia, PA 19111-5094
Ph: 215-697-2179
Fax: 215-697-2978
or
General Services Administration
Specifications Section
7th and D Street, SW, Room 6654
Washington, DC 20407
Ph: 202-708-9205
Fax: 202-708-9862

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)
933 No. Plum Grove Rd.
Schaumburg, IL 60173-4758
Ph: 708-517-1200
Fax: 708-517-1206

COPPER DEVELOPMENT ASSOCIATION (CDA)
P.O. Box 1840
Greenwich, CT 06836-1840
Ph: 203-625-8210

CORPS OF ENGINEERS (COE)
Order from:
U.S. Army Engineer Waterways Experiment Station
ATTN: Technical Report Distribution Section, Services Branch, TIC
3909 Halls Ferry Rd.
Vicksburg, MS 39180-6199
Ph: 601-634-2485
Fax: 601-634-2506

DEPARTMENT OF COMMERCE (DOC)
Order From:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Ph: 703-487-4604
Fax: 703-321-8547

DOOR AND HARDWARE INSTITUTE (DHI)
14170 Newbrook Dr.
Chantilly, VA 22021-2223
Ph: 703-222-2010
Fax: 703-222-2410

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)
245 Riverchase Parkway East, Suite O
Birmingham, AL 35244
Ph: 205-988-9870
Fax: 205-988-9822

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)
1151 Boston-Providence Turnpike
P.O. Box 9102
Norwood, MA 02062-9957
Ph: 617-762-4300
Fax: 617-762-9375

FEDERAL SPECIFICATIONS (FS)
Order from:
Standardization Documents Order Desk
Bldg 4D
700 Robbins Av
Philadelphia, PA 19111-5094
Ph: 215-697-2179
Fax: 215-697-2978

FEDERAL STANDARDS (FED-STD)
Order from:
Standardization Documents Order Desk
Bldg 4D
700 Robbins Av
Philadelphia, PA 19111-5094
Ph: 215-697-2179
Fax: 215-697-2978

FEDERAL TEST METHOD STANDARDS (FTM-STD)
Order from:
Standardization Documents Order Desk
Bldg 4D
700 Robbins Av
Philadelphia, PA 19111-5094
Ph: 215-697-2179
Fax: 215-697-2978

FLAT GLASS MARKETING ASSOCIATION (FGMA)
White Lakes Professional Bldg.
3310 Harrison
Topeka, KS 66611-2279
Ph: 913-266-7013
Fax: 913-266-0272

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCHR)
USC
KAP-200 University Park MC-2531
Los Angeles, CA 90089-2531
Ph: 213-740-2032

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 Hoes Ln.
Piscataway, NJ 08855-1331
Ph: 800-678-4333
Fax: 908-981-9667

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
127 Park St., NE
Vienna, VA 22180
Ph: 203-281-6613

MILITARY SHEET FORM STANDARDS (MSF-STD)

MILITARY SPECIFICATIONS (MS)
Order from:
Standardization Documents Order Desk
Building 4, Section D
700 Robbins Ave.
Philadelphia, PA 19111-5094
Ph: 215-697-2179
Fax: 215-697-2978
or
General Services Administration
Specification and Consumer Information Distribution Section (WFSLS)
Washington Navy Yard, Bldg. 197
Washington, DC 20407

MILITARY STANDARDS (MIL-STD)
Order from:
Standardization Documents Order Desk
Building 4, Section D
700 Robbins Ave.
Philadelphia, PA 19111-5094
Ph: 215-697-2179
Fax: 215-697-2978
or
General Services Administration
Specification and Consumer Information Distribution Section (WFSLS)
Washington Navy Yard, Bldg. 197
Washington, DC 20407

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)
P.O. Box 6808
Falls Church, VA 22046
Ph: 703-237-8100
Fax: 703-237-7442

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
2101 L St., NW
Washington, DC 20037
Ph: 202-457-8474
Fax: 202-457-8468

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
P.O. Box 9146
Quincy, MA 02269
Ph: 800-344-3555
Fax: 617-984-7057

NATIONAL FOREST PRODUCTS ASSOCIATION (NFOPA)
1250 Connecticut Ave., NW, Suite 200
Washington, DC 20036
Ph: 202-463-2766
Fax: 202-463-2791

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)
Publications and Programs Inquiries
Room E128, Administration Building
Gaithersburg, MD 20899
Ph: 301-975-3058

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)
1400 East Touhy Ave., Suite G-54
Des Plaines, IL 60018
Ph: 312-299-5200
Fax: 312-299-1286

PLUMBING AND DRAINAGE INSTITUTE (PDI)
1106 West 77th, South Dr.
Indianapolis, IN 46260-3318
Ph: 317-251-6970

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)
175 West Jackson Blvd.
Chicago, IL 60606
Ph: 312-786-0300
Fax: 312-786-0353

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)
P.O. Box 221230
Chantilly, VA 22022
Ph: 703-803-2980
Fax: 703-803-3732

STEEL DECK INSTITUTE (SDI)
P.O. Box 9506
Canton, OH 44711
Ph: 216-493-7886
Fax: 216-493-7886 (Fax Mach distinguishes bet voice and computer)

STEEL DOOR INSTITUTE (SDOI)
30200 Detroit Rd.
Cleveland, OH 44145-1967
Ph: 216-899-0010
Fax: 216-892-1404

STEEL STRUCTURES PAINTING COUNCIL (SSPC)
4400 Fifth Ave.
Pittsburgh, PA 15213-2683
Ph: 412-268-3455
Fax: 412-268-7048

TILE COUNCIL OF AMERICA (TCA)
P.O. Box 326
Princeton, NJ 08542-0326
Ph: 609-921-7050

UNDERWRITERS LABORATORIES (UL)
333 Pfingsten Rd.
Northbrook, IL 60062
Ph: 708-272-8800
Fax: 708-272-8129

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)
P.O. Box 23145
Portland, OR 97223
Ph: 503-639-0651
Fax: 503-684-8928

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)
Yeon Bldg.
522 SW 5th Ave.
Portland, OR 97204-2122
Ph: 503-224-3930
Fax: 503-224-3934

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)
P.O. Box 25278
Portland, OR 97225
Ph: 503-292-9288

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 01200

GENERAL REQUIREMENTS

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-- End of Table of Contents --

SECTION 01200

GENERAL REQUIREMENTS

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

1.1 Federal Specifications (FS).

FS FF-B-575	(Rev C) Bolt, Hexogon and Square
FS FF-N-105	(Rev B; Am 3, Int Am 4) Nails, Brads, Staples and Spikes: Wire, Cut and Wrought
FS FF-N-836	(Rev D; Am 2) Nut, Square, Hexagon, Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat
FS MM-L-751	(Rev H) Lumber; Softwood
FS TT-E-529	(Rev D) Enamel, Alkyd, Semi-Gloss
FS TT-P-25	(Rev E; Am 2) Primer Coating, Exterior (Undercoat for Wood, Ready-Mixed, White and Tints)

1.2 National Institute of Standards and Technology (NIST).

NIST PS 1	(1983) Construction and Industrial Plywood

1.3 U.S. Department of the Army, Corps of Engineers (COE) Engineer Manual.

COE EM 385-1-1	Safety and Health Requirements Manual (1 April 1981, Rev 1 October 1987)

2. PROJECT FACILITIES. The Contractor shall construct and/or erect the following project facilities.

2.1 Construction Signs. The signs shall be erected at the locations designated by the Contracting Officer as soon as possible and within 15 days after commencement of work under this contract.

2.1.1 One Project sign.

2.1.2 Four hard hat signs.

2.2 Bulletin Board at the Contractor's office.

2.3 Sanitary Facilities.

3. CONSTRUCTION SIGNS.

3.1 Materials.

3.1.1 Lumber shall conform to FS MM-L-751, and shall be seasoned Douglas Fir, S4S, Grade D or better except that posts, braces and spacers shall be construction Grade (WCLB).

3.1.2 Plywood shall conform to NIST PS 1, grade A-C, Group 1, exterior type.

3.1.3 Bolts, Nuts and Nails. Bolts shall conform to FS FF-B-575, nuts shall conform to FS FF-N-836, and nails shall conform to FS FF-N-105.

3.1.4 Paints and Oils. Paints shall conform to FS TT-P-25 for primer and FS TT-E-529 for finish paint and lettering.

3.2 Construction. Project, safety, and hard hat signs shall be constructed as detailed on the drawings attached at the end of this section. Decals will be furnished by the Contracting Officer.

3.3 Painting. All exposed surfaces and edges of plywood shall be given one coat of linseed oil and be wiped prior to applying primer. All exposed surfaces of signs and supports shall be given one coat of primer and 2 finish coats of white paint. Except as otherwise indicated, lettering on all signs shall be black and sized as indicated.

4. BULLETIN BOARD. A weatherproof bulletin board, approximately 36 inches wide and 30 inches high, with hinged glass door shall be provided adjacent to or mounted on the Contractor's project office. If adjacent to the office, the bulletin board shall be securely mounted on no less than 2 posts. Bulletin board and posts shall be painted or have other approved factory finish. The bulletin board shall be easily accessible at all times and shall contain wage rates, equal opportunity notice, and such other items required to be posted.

5. MAINTENANCE AND DISPOSAL OF PROJECT FACILITIES. The Contractor shall maintain the project facilities in good condition throughout the life of the project. Upon completion of work under this contract, the facilities covered under this section will remain the property of the Contractor and shall be removed from the site at his expense.

6. SCRAP MATERIAL. Materials indicated to be removed and not indicated to be salvaged, stored or reinstalled are designated as scrap and shall become the property of the Contractor and be removed from the site of work. The Contractor by signing this contract hereby acknowledges that he made due allowance for value, if any, of such scrap in the contract price.

7. SALVAGE MATERIALS. All materials and/or equipment removed and indicated to be either stored or reinstalled are designated as salvaged materials and/or equipment. Any salvaged materials and equipment which are excess upon completion of the work and are not indicated to be stored shall become the property of the Contractor.

8. ARCHAEOLOGICAL FINDINGS DURING CONSTRUCTION. There are known archaeological remains at the project site and they shall be avoided. All construction activities shall be restricted to the designated construction area. Should archaeological

remains be uncovered, the Contractor shall suspend operations at the site of discovery and continue operations in other areas. The removal of any Indian burial grounds or remains, ceremonial objects, petroglyphs, and archaeological and other artifacts of like nature found within the construction areas will be accomplished by the Government. In the event the Contractor's operations uncover, or his employees find any of the above described objects or materials within the construction areas, it shall be incumbent on the Contractor to notify immediately the Project Engineer or his authorized representative as to what has been found. The Project Engineer, when so notified of such findings, will determine the disposition in accordance with prescribed regulations. Any remains from burials, including Indian ceremonial objects, or other remains of the like nature found within the construction area, shall not be destroyed or removed. Should petroglyphs or archaeological material be discovered, the Contractor shall modify his operations so as not to disturb the findings pending receipt of notification from the Project Engineer of his determination of the final disposition of such findings. Any discoveries of the anthropological or archaeological nature upon the rights-of-way or upon Government property shall remain the property of the Government and not become the property of the person or persons making the discovery. Should the discovery site require archaeological studies resulting in delays and/or additional work, the Contractor will be compensated by an equitable adjustment under the CONTRACT CLAUSES of the contract.

9. PUBLIC UTILITIES, NOTICES, AND RESTRICTIONS.

9.1 General. The approximate location of all railroads, pipe lines, power and communication lines, and other utilities known to exist within the limits of the work are indicated on the drawings. The sizes, locations, and names of owners of such utilities are given from available information, but their accuracy is not guaranteed. Except as otherwise indicated on the drawings, all existing utilities will be left in place and the Contractor shall conduct his operations in such a manner that the utilities will be protected from damage at all times, or arrangements shall be made by the Contractor for their relocation at the Contractor's own expense. The Contractor shall be responsible for any damage to utilities known to exist and shall reimburse the owners for such damage caused by his operations.

9.2 Relocation or Removal. Utilities to be relocated or removed not as part of this contract are designated "To be Relocated by Others" or "To be Removed by Others", respectively. Utilities shown on the plans and not so designated will be left in place and be subject to the provisions of the CONTRACT CLAUSE: PROTECTION OF EXISTING VEGETATION, STRUCTURES, UTILITIES, AND IMPROVEMENTS. The Contractor may make arrangements with the owner for the temporary relocation and restoration of utilities not designated to be relocated, or for additional work in excess of the work needed to relocate utilities designated for relocation at no additional cost to the Government.

9.3 Utilities Not Shown. If the Contractor encounters, within the construction limits of the entire project, utilities not shown on the plans and not visible as of the date of this contract and if such utilities will interfere with construction operations, he shall immediately notify the Contracting Officer in writing to enable a determination by the Contracting Officer as to the necessity for removal or relocation. If such utilities are left in place, removed or relocated, as directed by the Contracting Officer, the Contractor shall be entitled to an equitable adjustment for any additional work or delay.

9.4 Coordination. The Contractor shall consult and cooperate with the owner of utilities that are to be relocated or removed by others to establish a mutual performance schedule and to enable coordination of such work with the construction work. These consultations shall be held as soon as possible after award of the contract or sufficiently in advance of anticipated interference with construction operations to provide required time for the removal or relocation of affected utilities.

9.5 Notices.

9.5.1 Traffic Routing. The Contractor shall notify the Contracting Officer 14 days in advance of the time work will be started in areas requiring the rerouting of traffic, traffic lane striping, and removal of street signs. The foregoing shall apply to progressive modifications of traffic routings within an area in which work is in progress.

9.5.2 Police, Highway Patrol, and Fire Departments shall be notified by the Contractor whenever a street is to be closed to traffic. If the closing is to be of long duration, a single notification to each department on the last working day before closing will be sufficient. A single notification shall then be made at the time the street is again opened to traffic. If the closing is to be of short duration or if different sections of the street are to be closed at different times, notifications shall be made on a day-to-day basis.

9.5.3 Utilities To be Relocated or Protected. Unless otherwise specified, the Contractor shall notify the Contracting Officer, in writing, 30 calendar days prior to starting work on any utility to be relocated or protected. On each relocation, notification shall include dates on which the Contractor plans excavation, by-pass work, removal work and/or installation work, as applicable. The Contractor shall also notify the following representatives of utility owners not less than 14 days prior to start of work in the vicinity of their respective utilitiesL

Flood Control District of Maricopa County
3335 West Durange Street
Phoenix, Arizona 85009
Mr. Bob Payette
Telephone: (602) 262-1501

Southwest Gas Corporation
9 South 43rd Avenue
Phoenix, Arizona 85072-2075
Mr. Ron Morency
Telephone: (602) 484-5306

City of Phoenix
Engineering Department
125 E. Washington Street
Phoenix, Arizona 85004
Mr. Dwayne Williams
Telephone: (602) 256-3441

Arizona Public Service
Metro Engineering Service
P.O. Box 21666
2121 W. Cheryl Drive
Phoenix, Arizona 85036
Ms. Lois Winkler
Telephone: (602) 371-6837

Salt River Project
Operations - Water
P.O. Box 1980
Phoenix, Arizona 85001
Mr. Timothy S. Phillips
Telephone: (602) 236-2956

Salt River Project - Electrical
Mr. Chuck Hughes
Telephone: (602) 236-2090

City of Phoenix
Water Department
Mr. Gerald Arakaki
Telephone: (602) 261-8229

Dimension Cable Services
Mr. Blair Tanner or Mr. John Barnett
Telephone: (602) 866-0072

U.S. West Communications
6350 S. Maple Avenue
Tempe, Arizona 85283
Mr. Curt Sayer
Telephone: (602) 831-4777
or
Mr. Rober Friess
2233 W. Dunlap Avenue
Room 205
Phoenix, Arizona 85021
Telephone: (602) 395-2550

9.5.3.1 Staking of Utilities. In addition to notification of reprensentatives of utitlity owners, the Contractor shall notify the Blue Stakes Center, phone (602) 263-1100, not less than 7 calendar days prior to start of excavation within street right-of-way or, work in the vicinity of known underground utilities, to have underground utilities located and staked.

9.5.3.2 The Contractor shall notify the Contracting Officer in writing at least 72 hours in advance of any proposed utility shut-offs. Maximum time for shut-off shall not exceed 6 hours. All outages will be subject to the approval of the Contracting Officer.

9.5.4 The Contractor shall notify the Contracting Officer, in writing, not less than 14 days in advance of the date on which he will complete trenching, excavation, fill or rough grading, as applicable, at each location where such completed work is required for temporary or permanent relocations by others. The Contractor shall allow a period of 14 calendar days at each relocation, after which time the Contractor may resume his operations.

9.5.5 Existing Bench Marks and R/W Markers. The Contractor shall notify the Contracting Officer, in writing, 7 days in advance of the time he proposes to remove any bench mark or right-of-way marker.

9.6 Restrictions.

9.6.1 Representatives of Other Agencies. Personnel representing owners and agencies maybe present for various portions of the work. However, the Contractor will be responsible only to the Contracting Officer.

9.6.2 Material Storage. All equipment and material (existing or new) which is not in use, but will be installed in the work, or equipment and materials in use by the Contractor, shall be stored on the jobsite within the construction limits, and only in areas approved by the Contracting Officer. Damage, loss, or theft of such equipment and material shall be at the Contractor's expense.

9.6.3 Waste and Disposal. There is no disposal area available on the base for disposal of waste generated from the work. Waste shall be removed on a daily basis by the Contractor to a suitable off-base location(s) approved by the Contracting Officer.

9.6.4 Storm Protection. When warnings of gale force or stronger winds are issued, the Contractor shall take every practicable precaution to minimize damage to persons, work in progress or completed, and adjacent property. These precautions shall include removing loose stored materials, tools, and/or equipment from exposed locations and removing or securing temporary structures.

9.6.5 Facility Damages. The Contractor shall be responsible for any and all damages to existing buildings and facilities incurred by his work forces or equipment, and shall repair said damages to the complete satisfaction of the Contracting Officer at no additional expense to the Government.

9.6.6 Working Hours. The Contractor shall restrict all construction activities to the following schedule:

Monday through Friday	6 a.m. to 7 p.m.
Saturday	8 a.m. to 6 p.m.

No work will be permitted on Sundays or Federal Holidays.

9.6.7 Final Inspection. The Contractor shall request a final inspection, in writing, 14 days in advance of the date work is expected to be completed. Final clean-up shall be accomplished prior to the final inspection.

9.6.8 Coordination with Flood Control District of Maricopa County. The Contractor shall be expected to cooperate with Maricopa County Flood Control District to allow the District the necessary access to complete its maintenance of the channel and coordinate the FCDMC construction of access ramps to the existing maintenance roads.

10. PUBLIC SAFETY. Attention is invited to the CONTRACT CLAUSE: PERMITS AND RESPONSIBILITIES. The Contractor shall provide temporary fencing, barricades, and/or guards, as required, to provide protection in the interest of public safety. As a minimum, this will include an 8 foot high chain-link fence which completely endoses each and every part of the project. The plan of this temporary fence shall be furnished to the Contracting Officer for approval and the fence erected prior to commencement of any work. Whenever the Contractor's operations create a condition hazardous to the public, he shall furnish at his own expense and without cost to the Government, such flagmen and guards as are necessary to give adequate warning to the public of any dangerous conditions to be encountered and he shall furnish, erect, or maintain such fences, barricades, lights, signs and other devices as are necessary to prevent accidents and avoid damage or injury to the public. Flagmen and guards, while on duty and assigned to give warning and safety devices shall conform to applicable city, county, and state requirements. Should the Contractor appear to be neglectful or negligent in furnishing adequate warning and protection measures, the Contracting Officer may direct attention to the existence of a hazard and the necessary warning and protective measures shall be furnished and installed by the Contractor without additional cost to the Government. Should the Contracting Officer point out the inadequacy of warning and protective measures, such action of the Contracting Officer shall not relieve the Contractor from any responsibility for public safety or abrogate his obligation to furnish and pay for those devices. The installation of any general illumination shall not relieve the Contractor of his responsibility for furnishing and maintaining any protective facility.

11. OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA) STANDARDS. The OCCUPATIONAL SAFETY and HEALTH ACT (OSHA) STANDARDS for CONSTRUCTION (Title 29, Code of Federal Regulations Part 1926 as revised from time to time) and the Corps of Engineers General Safety and Health Requirements Manual, EM 385-1-1, are both applicable to this contract. The most stringent requirement of the two standards will be applicable.

12. PERMITS.

12.1 General. Reference is made to the article of the contract entitled "Permits and Responsibilities". The Contractor must obtain all required licenses and permits, including but not limited to those listed.

13. REQUIRED INSURANCE.

13.1 Reference is made to the CONTRACT CLAUSE: INSURANCE--WORK ON A GOVERNMENT INSTALLATION which obligates the Contractor to procure and maintain during the entire period of his performance under this contract the following minimum insurance.

13.1.1 Either Workmen's Compensation or Employer's Liability Insurance with a minimum limit of $300,000.

13.1.2 Comprehensive Liability Insurance for Bodily Injury and Property Damage with minimum limits of $100,000 for injury to or death of any person; $300,000 for each accident or occurrence for bodily injury liability; and $25,000 for each accident or occurrence for property damage liability.

13.1.3 Automobile Liability Insurance for Bodily Injury and Property Damage with minimum limits of $100,000 for injury to or death of any one person; $300,000 for each accident or occurrence for bodily injury liability; and $25,000 for each accident or occurrence for property damage liability.

13.1.4 In every case the insurance coverage shall amount to at least the limits stated above. However, where the Financial Responsibility Compulsory Insurance Law of the State in which the installation is located requires higher limits, the Automobile Liability Insurance Policy should provide coverage of at least those limits.

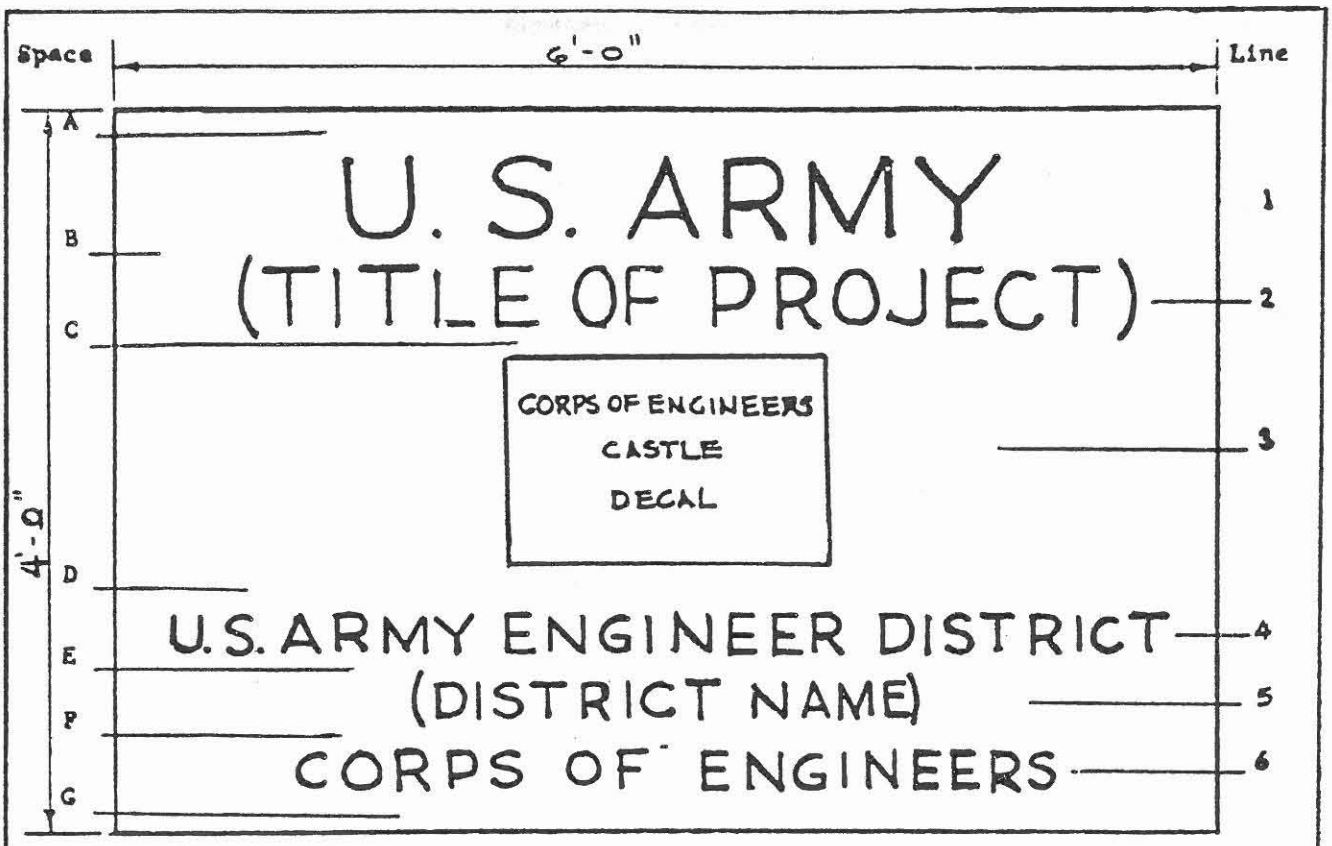
14. WRITTEN GUARANTEES AND GUARANTOR'S LOCAL REPRESENTATIVE. Prior to completion of the contract, the Contractor shall obtain and furnish to the Contracting Officer's representative written guarantees for all the equipment and/or appliances furnished under this contract. The Contractor shall furnish with each guarantee: The name, address, and telephone number of the guarantor's representative nearest to the location where the equipment and/or appliances are installed, who, upon request of the Using Service's representative, will honor the guarantee during the guaranty period and will provide the services prescribed by the terms of the guarantee.

15. PRICING OF CONTRACTOR-FURNISHED PROPERTY. At the request of the Contracting Officer, the Contractor shall promptly furnish and shall cause any subcontractors to furnish, in like manner, unit prices and descriptive data required by the Government for property record purposes of fixtures and equipment furnished and installed by the Contractor.

16. PROJECT ENGINEER'S OFFICE.

16.1 General. The Contractor shall provide a suitable 10' x 50' office trailer for the Project Engineer. The exact site will require the Contracting Officer's approval. The trailer shall be adequately heated, well lighted, suitably ventilated, and cooled with a properly sized refrigeration type air conditioning unit, complete, with all piping and electrical connections. An adequate supply of cooled drinking water, sewer, telephone, and electrical services shall be furnished and maintained. Open parking space for 6 vehicles and water and sanitary facilities shall be located convenient to the office. The combined parking and building area shall be enclosed with a woven wire fence approximately 6 feet high with a 10-foot wide lockable gate accessible from a road or street. The fenced area shall be of sufficient size to permit ease in the parking of vehicles. Materials for the facilities need not be new provided they are adequate for the intended use. The cost for sewer, water, power, and telephone usage will be the responsibility of the Contractor except that the Contractor will be reimbursed for any long distance telephone charges.

-- End of Section --



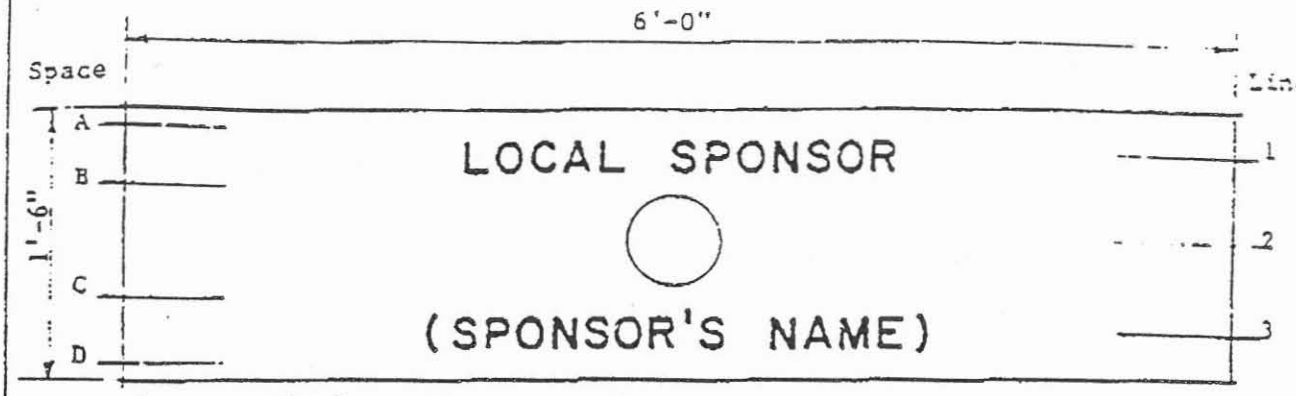
S C H E D U L E

Space	Height	Line	Description	Letter Height	Stroke
A	3"				
		1	U. S. ARMY	5 1/2"	7/8"
B	2"				
		2	PROJECT NOMENCLATURE	4"	5/8"
C	2"				
		3	CORPS OF ENGINEERS CASTLE (DECAL)	14"	--
D	3"				
		4	U. S. ARMY ENGINEER DISTRICT	2 3/4"	3/8"
E	2"				
		5	DISTRICT NAME	2 1/4"	1/4"
F	2"				
		6	CORPS OF ENGINEERS	2 1/2"	3/8"
G	3"				

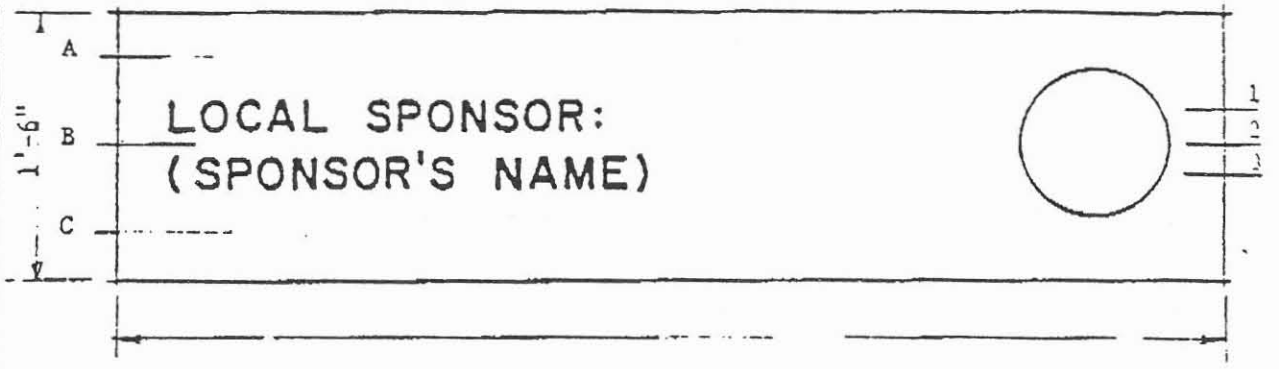
Lettering Color -- Black

PROJECT SIGN
(Army-Civil Works)

Figure 1
14 August 1972



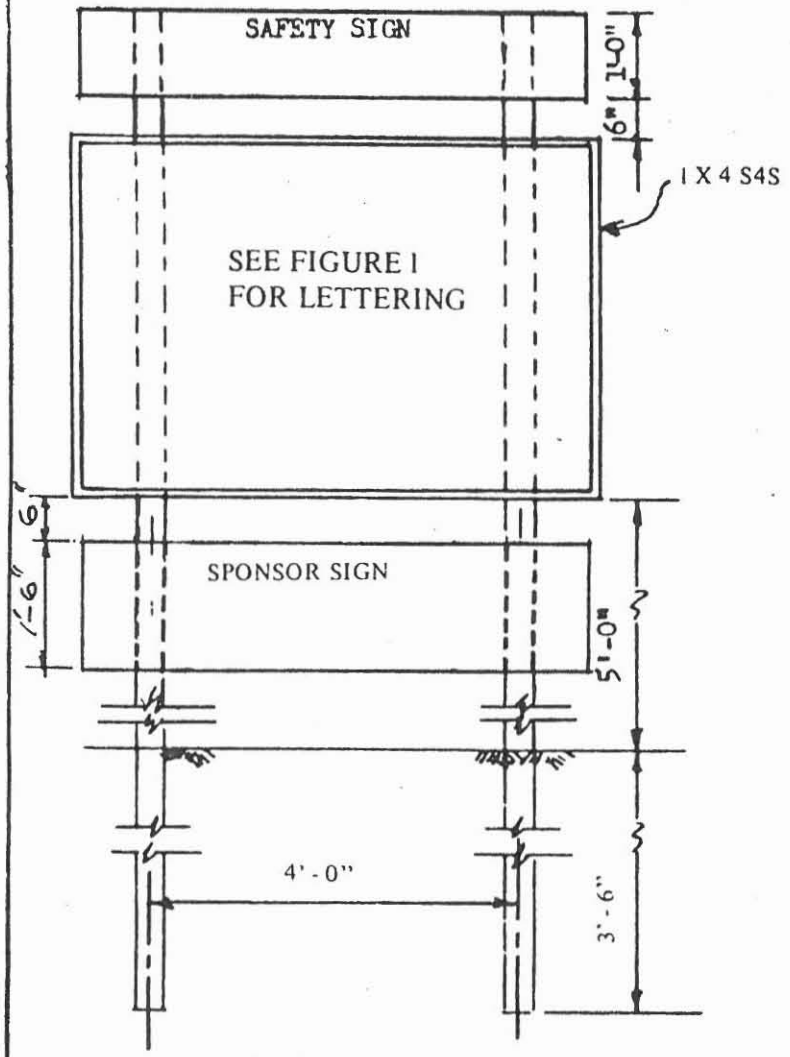
Space	Height	Line	Description	Letter Height	Stroke
A	2"				
		1	LOCAL SPONSOR	2"	3/8"
B	2" Min.				
		2	SPONSOR'S EMBLEM (DECAL)		
C	2" Min.				
		3	SPONSOR'S NAME	2"	3/8"
D	2"				



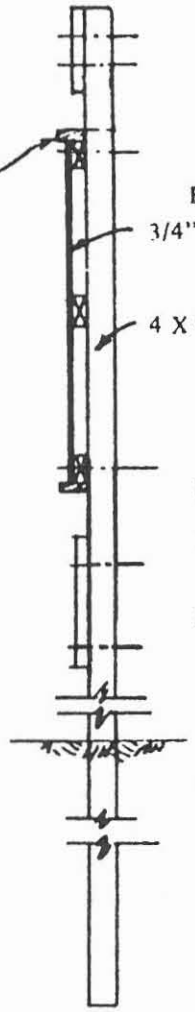
Space	Height	Line	Description	Letter Height	Stroke
A	6"				
		1	LOCAL SPONSOR	2"	3/8"
B	2"				
		2	SPONSOR'S EMBLEM (DECAL)		
C	6"				
		3	SPONSOR'S NAME	2"	3/8"

Lettering Color -- Black

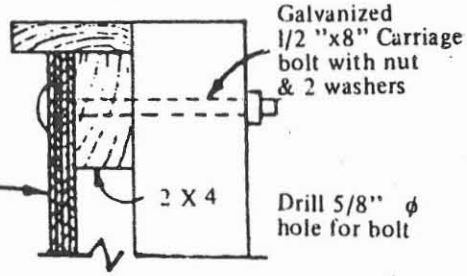
Figure 1A
21 February 1975



ELEVATION



SECTION



DETAIL

General Notes

1 - Lumber to be cut & formed accurately.

2 - Secure 1 X 4 and plywood with 6d finish nails at not less than 12" O.C.

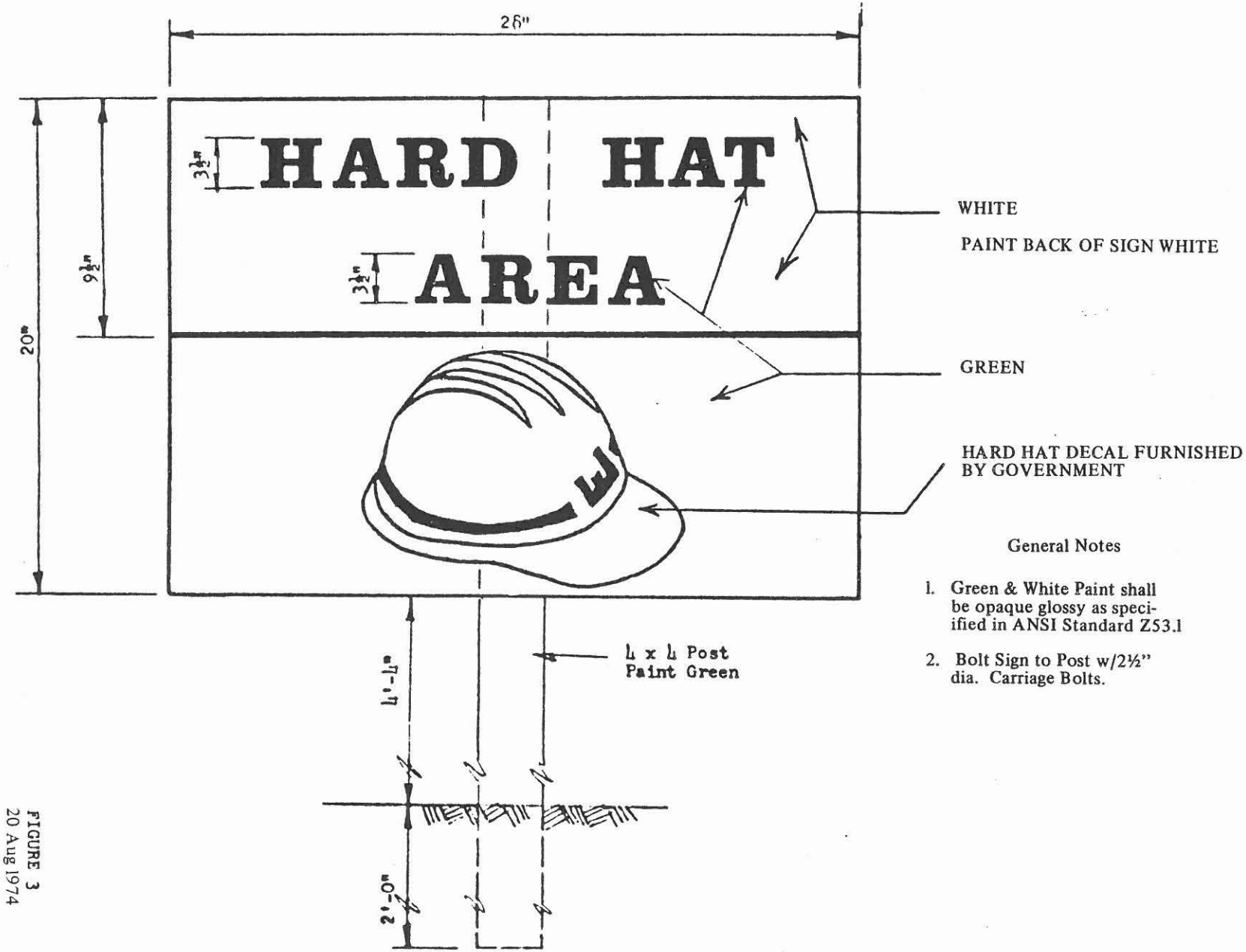
3 - All exposed nails to be set & holes filled with putty.

4 - Sign to be set in good solid ground & backfill carefully tamped into place.

5 - Where necessary, posts shall be braced to provide a solid installation.

SIGN DETAILS

Figure 2
25 February 1975



General Notes

1. Green & White Paint shall be opaque glossy as specified in ANSI Standard Z53.1
2. Bolt Sign to Post w/2½" dia. Carriage Bolts.

FIGURE 3
20 Aug 1974

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GENERAL REQUIREMENTS

SECTION 01300

SUBMITTAL DESCRIPTIONS

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PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Table of Contents --

SECTION 01300

SUBMITTAL DESCRIPTIONS

PART 1 GENERAL

1.1 SUBMITTALS

The submittals described below are those required and further described in other sections of the specifications. Other requirements pertaining to submittals are included in the SPECIAL CLAUSES and SECTION: SUBMITTAL PROCEDURES. Submittals required by the CONTRACT CLAUSES and other nontechnical parts of the contract are not included in this section.

SD-01, Data

Submittals which provide calculations, descriptions, or documentation regarding the work.

SD-04, Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication, layouts of particular elements, connections, and other relational aspects of the work.

SD-06, Instructions

Preprinted material describing installation of a product, system or material, including special notices and material safety data sheets, if any, concerning impedances, hazards, and safety precautions.

SD-07, Schedules

Tabular lists showing location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

SD-08, Statements

A document, required of the Contractor, or through the Contractor, from a supplier, installer, manufacturer, or other lower tier Contractor, the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

SD-09, Reports

Reports of inspections or tests, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used shall be identified and test results shall be recorded.

SD-13, Certificates

Statement signed by responsible official of a manufacturer of a product, system or material, attesting that the product, system or material meets specified requirements. The statement must be dated after the award of this contract, must name the project, and must list the specific requirements which are being certified.

SD-14, Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

SD-18, Records

Documentation to record compliance with technical or administrative requirements.

SD-19, Operation and Maintenance Manuals

Data which forms a part of an operation and maintenance manual.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

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GENERAL REQUIREMENTS

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SECTION 01305

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.1.1 Government Approved

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.1.2 Information Only

All submittals not requiring Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.2 APPROVED SUBMITTALS

The approval of submittals by the Contracting Officer shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the CQC requirements of this contract, is responsible for the dimensions and design of adequate connections, details and satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be given consideration unless accompanied by an explanation as to why a substitution is necessary.

1.3 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies as specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, notice as required under the Contract Clause entitled "Changes" shall be given promptly to the Contracting Officer.

1.4 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The Contractor shall submit all items listed on the Submittal Register (ENG Form 4288) or specified in the other sections of these specifications. The Contracting Officer may request submittals in addition to those listed when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same used in the contract drawings. Submittals shall be made in the respective number of copies and to the respective addresses set forth below. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) representative and each respective transmittal form (ENG Form 4025) shall be stamped, signed, and dated by the CQC representative certifying that the accompanying submittal complies with the contract requirements. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals including parts list; certifications; warranties and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby.

3.2 SUBMITTAL REGISTER (ENG Form 4288)

At the end of this section is one set of ENG Forms 4288 listing each item of equipment and material for which submittals are required by the specifications. Columns "c" thru "o" have been completed by the Government. The Contractor shall complete columns "a," "b," and "p" thru "u" and return 6 completed copies to the Contracting Officer for approval within 2 calendar days after Notice to Proceed for approval. The approved submittal register will become the scheduling document and will be used to control submittals throughout the life of the contract. This register and the progress schedules shall be coordinated.

3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 14 calendar days exclusive of mailing time) shall be allowed on the register for review and approval. No delays damages or time extensions will be allowed for time lost in late submittals. An additional 7 calendar days shall be allowed and shown on the register for review and approval of submittals for refrigeration and HVAC control systems.

3.4 TRANSMITTAL FORM (ENG Form 4025)

The sample transmittal for (ENG Form 4025) attached to this section shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to

the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care will be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

3.5.1 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

3.6 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

3.7 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and date. Five (5) copies of the submittal will be retained by the Contracting Officer and 1 copy of the submittal will be returned to the Contractor.

3.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. These submittals will be used for information purposes. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications and will not prevent the Contracting Office from requiring removal and replacement if nonconforming material is incorporated in the work. This does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or check testing by the Government in those instances where the technical specifications so prescribe.

3.9 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR

(Firm Name)

_____ Approved

_____ Approved with corrections as noted on submittal data and/or attached sheets(s).

SIGNATURE: _____

TITLE: _____

DATE: _____

-- End of Section --

SUBMITTAL REGISTER
(ER 415-1-10)

CONTRACT NO.

TITLE AND LOCATION: Cultural Resources Interpretive Center, Hedgpeth Hills, Maricopa County, Arizona

CONTRACTOR

SPECIFICATION SECTION

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		SECTION	02221, EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS																					
		1.3.1	Soil Treatment Agent	X		X				X				X										
		SECTION	02222, EXCAVATION, FILLING AND BACKFILLING FOR UTILITIES SYSTEMS																					
		1.3.1	Field Density Tests						X				X											
		1.3.1	Testing of Backfill																					
			Materials						X				X											
		SECTION	02660, WATER LINES																					
		1.3.1	Design Analysis and																					
			Calculations	X					X					X										
		1.3.2	Manufacturer's																					
			Instructions		X	X							X											
		1.3.3	Safety Plan						X					X										
		1.3.4	Training Data	X		X				X			X											
		1.3.5	Certificates of																					
			Compliance							X				X										

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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		1.3.6	Records									X	X											
		SECTION	02730, SANITARY SEWERS																					
		1.3.1	Portland Cement							X			X											
		SECTION	02811, UNDERGROUND IRRIGATION SYSTEMS																					
		1.3.1	Design Analysis and																					
			Calculations	X										X										
		1.3.1	Spare Parts	X										X										
		1.3.2	Irrigation System		X									X										
		1.3.3	Irrigation System			X								X										
		1.3.4	Field Tests						X					X										
		1.3.5	Irrigation System			X								X										
		1.3.6	Irrigation System		X									X										
		SECTION	02831, FENCE, CHAIN-LINK																					
		1.2.1	Chain-Link Fence		X									X										

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		SECTION	02936, WILD FLOWERS																					
		1.2.1	Delivery					X					X											
		1.2.1	Maintenance Report					X					X											
		1.2.1	Wildflower Establish-																					
			ment Period					X					X											
		1.2.2	Seed							X				X										
		SECTION	02950, TREES, SHRUBS, GROUND COVERS, AND VINES																					
		1.2.1	Pesticide Material				X							X										
		1.2.2	Delivery					X						X										
		1.2.2	Application of Pesti-																					
			cide Material				X			X				X										
		1.2.3	Soil Test						X					X										
		1.2.3	Percolation Test						X					X										
		1.2.4	Soil Amendments							X				X										
		1.2.4	Plants							X				X										

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		1.2.4	Pesticide							X				X										
		1.2.5	Plant Establishment																					
			Period									X		X										
		1.2.5	Maintenance Report									X		X										
		1.2.5	Maintenance Instruc-																					
			tions									X		X										
		SECTION	02951, ROCK COLOR TREATMENT																					
		1.1	Rock Color Treatment	X			X				X		X											
		SECTION	03301, CAST-IN-PLACE CONCRETE																					
		1.2.1	Concrete Mixture																					
			Proportions	X					X					X										
		1.2.2	Sampling and Testing						X	X				X										
		1.2.3	Cement & Pozzoloan						X	X				X										
		1.2.4	Non-shrink Grout					X		X				X										
		1.2.5	Formwork Design	X	X				X	X				X										

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		SECTION	03450, PRECAST ARCHITECTURAL CONCRETE																					
		1.4.1	Calculations	X										X										
		1.4.1	Mix Design	X					X					X										
		1.4.2	Concrete System		X									X										
		1.4.3	Materials						X					X										
		1.4.4	Copper Slag Aggregate								X			X										
		1.4.4	Precast Concrete Wall								X			X										
		1.4.4	Manufacturer's Qualifications					X		X				X										
		SECTION	05055, WELDING, STRUCTURAL																					
		1.4.1	Welding Qualifications					X						X										
		1.4.1	Inspector Qualification					X						X										
		1.4.2	Quality Control									X		X										

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		SECTION	05120, STRUCTURAL STEEL																					
		1.3.1	Structural Steel		X									X										
		1.3.1	Structural Connections		X									X										
		1.3.2	Erection					X						X										
		1.3.3	Materials and Welders							X				X										
		1.3.3	Fabrication							X				X										
		1.3.4	High Strength Bolts								X			X										
		1.3.4	Carbon Steel Bolts								X			X										
		1.3.4	Carbon Steel Nuts								X			X										
		1.3.4	Washers								X			X										
		SECTION	05300, STEEL DECKING																					
		1.2.1	Deck Units	X										X										
		1.2.2	Deck Units, Accessories,																					
			Attachments, Holes																					
			and Openings		X									X										

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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		1.2.3	Deck Units and																					
			Attachments							X				X										
		1.2.4	Deck Units and																					
			Accessories								X			X										
		1.2.5	Attachments					X						X										
		SECTION	05500, MISCELLANEOUS METAL																					
		1.2.1	Misc. Metal Items		X									X										
		1.2.2	Misc. Metal Items								X			X										
		SECTION	06100, ROUGH CARPENTRY																					
		1.2.1	Grading and Marking							X				X										
		SECTION	06200, FINISH CARPENTRY																					
		1.2.1	Finish Carpentry		X									X										
		1.2.2	Maple Plywood Sidings								X		X											
		1.2.2	Maple Solid Stock																					
			Moldings								X		X											

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		SECTION	07220, ROOF INSULATION																					
		1.2.1	Application of																					
			Insulation			X								X										
		1.2.2	CQC					X						X										
		1.2.3	Insulation							X				X										
		1.2.3	Glass Roofing Felt							X				X										
		1.2.3	Orange Roofing Felt							X			X											
		SECTION	07530, ELASTOMENIC ROOFING																					
		1.3.1	Roofing System		X									X										
		1.3.2	Installation			X								X										
		1.3.3	Protection Plan					X						X										
		1.3.3	CQC					X						X										
		1.3.4	Materials							X				X										
		1.3.5	Materials								X			X										

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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		SECTION 07600, SHEET METAL WORK, GENERAL																						
		1.3.1	Sheet Metal		X									X										
		1.3.2	CQC				X	X					X											
		1.3.3	Materials								X			X										
		SECTION 07721 ROOF SKYLIGHTS																						
		1.3.1	Roof Skylights		X									X										
		SECTION 07920, CAULKING AND SEALANTS																						
		1.3.1	Materials	X										X										
		1.3.2	Materials							X			X											
		SECTION 08110, STEEL DOORS AND FRAMES																						
		1.2.1	Doors and Frames		X									X										
		SECTION 08201, WOOD DOORS AND FRAMES																						
		1.3.1	Wood Doors and Frames		X									X										
		1.3.2	Fire Rated Doors							X				X										
		1.3.3	Veneer								X			X										

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		1.3.3	Factory Coated																					
			Natural Finish								X			X										
		SECTION	08312, SLIDING DOORS																					
		1.3.1	Sliding Glass Doors		X									X										
		1.3.2	Sliding Glass Doors			X							X											
		SECTION	08330, OVERHEAD COILING DOORS																					
		1.4.1	Overhead Coiling Door																					
			Unit	X										X										
		1.4.2	Overh. Coil. Dr. Unit		X									X										
		1.4.3	Overh. Coil. Dr. Unit			X								X										
		1.4.4	Fire Doors							X				X										
		1.4.5	Overh. Coil. Dr. Unit			X								X										
		SECTION	08700, BUILDER'S HARDWARE																					
		1.2.1	Hardware & Accessories	X										X										
		1.2.2	Hardware Devices		X									X										

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		1.2.3	Hardware Schedule				X							X										
		1.2.3	Keying Schedule				X							X										
		1.2.4	Hardware & Accessories							X				X										
		1.2.5	Hardware & Accessories			X								X										
		SECTION	08810 GLASS AND GLAZING																					
		1.3.1	Glass & Settling																					
			Materials	X										X										
		1.3.2	Glazing Materials		X									X										
		1.3.3	Glass							X				X										
		SECTION	09250, GYPSUM WALLBOARD																					
		1.3.1	Steel Framing		X									X										
		1.3.1	Control Joints		X								X											
		1.3.1	Fire Resistant																					
			Assemblies		X									X										
		1.3.2	Gypsum Wallboard							X				X										

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(ER 415-1-10)

CONTRACT NO.

TITLE AND LOCATION: Cultural Resources Interpretive Center, Hedgpeth Hills, Maricopa County, Arizona

CONTRACTOR

SPECIFICATION SECTION

TRANSMITTAL NO. a.	ITEM NO. b.	SPECIFICATION PARAGRAPH NUMBER c.	DESCRIPTION OF ITEM SUBMITTED d.	TYPE OF SUBMITTAL: DATA e.	DRAWINGS f.	INSTRUCTIONS g.	SCHEDULES h.	STATEMENTS i.	REPORTS j.	CERTIFICATES k.	SAMPLES l.	RECORDS m.	CLASSIFICATION: INFORMATION ONLY n.	GOVERNMENT APPROVED o.	REVIEWER p.	CONTRACTOR SCHEDULE DATES: SUBMIT q.	APPROVAL NEEDED BY r.	MATERIAL NEEDED BY s.	CONTRACTOR ACTION: CODE t.	DATE u.	SUBMIT TO GOVERNMENT v.	GOVERNMENT ACTION: CODE w.	DATE x.	REMARKS y.
		1.3.2	Water-Resistant																					
			Gypsum Board							X				X										
		SECTION	09310, CERAMIC TILE																					
		1.2.1	Tile							X				X										
		1.2.2	Tile								X			X										
		SECTION	09510, ACOUSTICAL CEILINGS																					
		1.3.1	Acoustical Ceiling																					
			System	X		X								X										
		1.3.2	Acoust. Ceil. Syst.		X									X										
		1.3.3	Fire Resistive Ceilings						X	X			X											
		1.3.3	Ceiling Sound Trans-																					
			mission						X	X			X											
		1.3.4	Acoustical Units								X			X										

SUBMITTAL REGISTER
(ER 415-1-10)

CONTRACT NO.

TITLE AND LOCATION: Cultural Resources Interpretive Center, Hedgpeth Hills, Maricopa County, Arizona

CONTRACTOR

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		SECTION	09680, CARPET																					
		1.2.1	Carpet & Accessories			X								X										
		1.2.2	Carpet & Accessories							X				X										
		1.2.3	Carpet & Accessories								X			X										
		SECTION	09900, PAINTING, GENERAL																					
		1.3.1	Materials	X										X										
		1.3.2	Mixing & Thinning			X							X											
		1.3.2	Application			X							X											
		1.3.3	Materials						X					X										
		1.3.4	Coating								X			X										
		SECTION	10160, TOILET PARTITIONS																					
		1.3.1	Toilet Partitions		X									X										
		1.3.2	Toilet Partitions								X			X										
		SECTION	10200, FIRE EXTINGUISHERS																					
		1.3	Fire Extinguishers	X		X				X				X										

SUBMITTAL REGISTER
(ER 415-1-10)

CONTRACT NO.

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a.	b.	c.	d.	e.	f.	g.	h.	i.	j.	k.	l.	m.	n.	o.	p.	q.	r.	s.	t.	u.	v.	w.	x.	y.
		SECTION	10430, EXTERIOR SIGNAGE																					
		1.3.1	Exterior Signs		X	X								X										
		1.3.2	Exterior Signs								X			X										
		SECTION	10750, TELEPHONE ENCLOSURE																					
		1.4	Telephone Enclosure	X		X				X				X										
		SECTION	10800, TOILET ACCESSORIES																					
		1.2.1	Finishes & Accessories	X		X								X										
		1.2.2	Finishes & Accessories								X			X										
		SECTION	15400, PLUMBING, GENERAL PURPOSE																					
		1.3.1	Plumbing System		X									X										
		1.3.2	Tests, Flushing & Sterilization						X					X										
		1.3.3	Mat'ls & Equipment							X				X										
		1.3.3	Bolts							X				X										
		1.3.4	Plumbing System			X							X											

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		SECTION	15653, AIR CONDITIONING SYSTEM (UNITARY TYPE)																					
		1.3.1	Air-Condtn. System	X	X		X							X										
		1.3.2	Test Data						X					X										
		1.3.3	Matl's & Equipment							X				X										
		1.3.4	Air-Condtn. System			X								X										
		SECTION	15935, VENTILATION AND EXHAUST SYSTEMS																					
		1.3.1	Vent. & Exhaust Sys.	X	X		X							X										
		1.3.2	Vent. & Exhaust Sys.			X								X										
		SECTION	15990, TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS																					
		1.4.1	Testing & Balancing						X					X										
		1.4.2	Qualification							X			X											
		SECTION	16415, ELECTRICAL WORK, INTERIOR																					
		1.3.1	Electrical Work	X	X	X								X										
		1.3.2	Matl's & Equipment						X					X										

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		SECTION	16721, FIRE DETECTION & ALARM SYSTEM																					
		1.4.1	Battery	X										X										
		1.4.1	Voltage Drop	X										X										
		1.4.1	Spare Parts	X										X										
		1.4.1	Qualifications	X						X				X										
		1.4.2	Fire Alarm Report Sys.		X									X										
		1.4.3	Fire Alarm Report Sys.			X								X										
		1.4.3	Training	X		X								X										
		1.4.4	Test Procedures					X						X										
		1.4.5	Testing						X					X										
		1.4.6	Equipment							X			X											
		1.4.6	Installer							X			X											
		SECTION	16752, ELECTRONIC ENTRY CONTROL SYSTEM																					
		1.3	Technical Data and																					
			Computer Software	X	X	X			X					X										

ENG FORM 4288, May 91 EDITION OF AUG 89 IS OBSOLETE.

(Proponent CEMP-CE)

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE

(Read instructions on the reverse side prior to initiating this form)

DATE	TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS *(This section will be initiated by the contractor)*

TO:	FROM:	CONTRACT NO.	CHECK ONE: ☐ THIS IS A NEW TRANSMITTAL ☐ THIS IS A RESUBMITTAL OF TRANSMITTAL _____
SPECIFICATION SEC. NO. (Cover only one section with each transmittal)	PROJECT TITLE AND LOCATION		

ITEM NO. *a.*	DESCRIPTION OF ITEM SUBMITTED *(Type size, model number/etc.)* *b.*	MFG OR CONTR. CAT., CURVE DRAWING OR BROCHURE NO. *(See instruction no. 8)* *c.*	NO. OF COPIES *d.*	CONTRACT REFERENCE DOCUMENT		FOR CONTRACTOR USE CODE *g.*	VARIATION *(See instruction No. 6)* *h.*	FOR CE USE CODE *i.*
				SPEC. PARA. NO. *e.*	DRAWING SHEET NO. *f.*			

REMARKS

I certify that the above submitted items have been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as other wise stated.

_____

NAME AND SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED (List by Item No.)	NAME, TITLE AND SIGNATURE OF APPROVING AUTHORITY	DATE

INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies

2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No." This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.

3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288 for each entry on this form.

4. Submittals requiring expeditious handling will be submitted on a separate form.

5. Separate transmittal form will be used for submittals under separate sections of the specifications.

6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".

7. Form is self-transmittal, letter of transmittal is not required.

8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.

9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

A	--	Approved as submitted	E	--	Disapproved (See attached)
B	--	Approved, except as noted on drawings.	F	--	Receipt acknowledged
C	--	Approved, except as noted on drawings. Refer to attached sheet resubmission required.	FX	--	Receipt acknowledged, does not comply as noted with contract requirements
D	--	Will be returned by separate correspondence.	G	--	Other *(Specify)*

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

*U.S. Government Printing Office: 1991 — 523-366/40098

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SECTION 01430

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 DEFINITIONS

For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, and land, and includes management of visual aesthetics, noise, solid waste, radiant energy and radioactive materials, as well as other pollutants.

1.2 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including but not limited to water, air, and noise pollution.

1.2.1 Environmental Protection Plan

Within 15 days after receipt of Notice of Award of the contract and at least 7 days prior to the Preconstruction Conference, the Contractor shall submit in writing an Environmental Protection Plan and meet with representatives of the Contracting Officer to develop mutual understanding relative to compliance with this provision and administration of the environmental protection program. Approval of the Contractor's plan will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and other environmental protection measures. The Government reserves the right to make changes in his environmental protection plan and operations as necessary to maintain satisfactory environmental protection performance. The environmental protection plan shall include but not be limited to the following:

1.2.1.1 Laws, Regulations, and Permits

The Contractor shall prepare a list of Federal, State and local laws, regulations, and permits concerning environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations and permits.

1.2.1.2 Protection of Features

The Contractor shall determine methods for the protection of features to be preserved within authorized work areas. The Contractor shall prepare a listing of methods to protect resources needing protection, i.e., trees, shrubs, vines, grasses and ground

cover, landscape features, air and water quality, fish and wildlife, soil, historical, archaeological and cultural resources.

1.2.1.3 Procedures

The Contractor shall implement procedures to provide the required environmental protection and to comply with the applicable laws and regulations. The Contractor shall set out the procedures to be followed to correct pollution of the environment due to accident, natural causes or environmental protection plan.

1.2.1.4 Permit or License

The Contractor shall obtain all needed permits or licenses.

1.2.1.5 Drawings

The Contractor shall include drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, stockpiles of earth materials, and disposal areas for excess earth material and unsatisfactory earth materials.

1.2.1.6 Environmental Monitoring Plans

The Contractor shall include environmental monitoring plans for the job site which incorporate land, water, air and noise monitoring.

1.2.1.7 Traffic Control Plan

The Contractor shall include a traffic control plan for the job site.

1.2.1.8 Surface and Ground Water

The Contractor shall establish methods of protecting surface and ground water during construction activities.

1.2.1.9 Work Area Plan

The Contractor shall include a work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. The plan shall include measures for marking the limits of use areas.

1.2.1.10 Plan of Borrow Area(s)

The Contractor shall include a plan of borrow area(s) for the job site.

1.3 SUBCONTRACTORS

Assurance of compliance with this section by subcontractors will be the responsibility of the Contractor.

1.4 PERMITS OBTAINED BY CORPS OF ENGINEERS

The Corps of Engineers will not obtain any permits for this project. See Contract Clause entitled "PERMITS AND RESPONSIBILITIES".

1.5 REGULATORY REQUIREMENTS

The Contractor shall comply with all state regulatory and statutory requirements.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 PROTECTION OF ENVIRONMENTAL RESOURCES

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall confine his activities to areas defined by the contract drawings or specifications. Environmental protection shall be as stated in the following subparagraphs.

3.1.1 Protection of Land Resources

Prior to the beginning of any construction, the Contracting Officer will identify all land resources to be preserved within the Contractor's work area. The Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without special permission from the Contracting Officer. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such special emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs.

3.1.1.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas where no work is to be performed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence and during all construction operations. Where construction operations are to be conducted during darkness, the markers shall be visible during darkness. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects. All access through non-work areas shall be along established right-of-ways, roads or maintenance roads. New access ways shall not be established through the existing landscape without the expressed permission of the Contracting Officer.

3.1.1.2 Protection of Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features to be preserved, indicated and defined on the drawings submitted by the Contractor as a part of the Environmental Protection Plan, shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques.

3.1.1.3 Reduction of Exposure of Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated and specified. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in instances where the constructed feature obscures borrow areas, quarries and waste material areas, these areas shall not initially be cleared in total. Clearing of such areas shall progress in reasonably sized increments as needed to use the areas developed as approved by the Contracting Officer.

3.1.1.4 Temporary Protection of Disturbed Areas

Such methods as necessary shall be utilized to effectively prevent erosion and control sedimentation. Runoff from the construction site shall be controlled by construction of diversion ditches, trenches, and berms to retard and divert runoff to protected drainage courses, and any measure required by area-wide plans approved under paragraph 208 of the Clean Water Act.

3.1.1.5 Erosion and Sedimentation Control Devices

The Contractor shall construct or install all temporary and permanent erosion and sedimentation control features as necessary. Temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, and mulching shall be maintained by the Contractor until the completion of the project.

3.1.1.6 Location of Contractor Facilities

The Contractor's field offices, staging areas, stockpiles, storage, and temporary buildings shall be placed in areas designated on the contract drawings and approved by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only on approval by the Contracting Officer.

3.1.1.7 Borrow Areas on Government Property

Borrow areas on government property shall be managed to minimize erosion and to prevent sediment from entering nearby water courses or lakes.

3.1.1.8 Disposal Areas on Government Property

Disposal areas on government property shall be managed and controlled to limit material to areas designated on the contract drawings and prevent erosion of soil or sediment from entering nearby water courses or lakes. Disposal areas shall be developed in accordance with the grading plan indicated on the contract drawings.

3.1.1.9 Temporary Excavation and Embankments

Temporary excavation and embankments shall be controlled to protect adjacent areas from contamination.

3.1.1.10 Disposal of Solid Wastes

Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. All handling and disposal shall be conducted to prevent contamination.

3.1.1.11 Disposal of Chemical Wastes

Chemical wastes shall be stored in corrosion resistant containers, removed from the work area and disposed of in accordance with Federal, State, and local regulations.

3.1.1.12 Disposal of Discarded Materials

Discarded materials other than those which can be included in the solid waste category shall be handled as directed by the Contracting Officer.

3.2 PRESERVATION AND RECOVER OF HISTORICAL, ARCHAEOLOGICAL AND CULTURAL RESOURCES

Existing historical, archaeological and cultural resources within the Contractor's work area will be so designated by the Contracting Officer and precautions taken to preserve all such resources as they existed at the time they were pointed out to the Contractor. The Contractor shall install all protection for these resources so designated on the drawings and shall be responsible for their preservation during this contract. If during construction activities the Contractor observes unusual items that might have historical or archaeological value, such observations shall be reported as soon as practicable to the Contracting Officer. Recording and preservation of historical and archaeological finds during construction activities are included in this contract.

3.2.1 Washing and Curing Water

Waste waters directly derived from construction activities shall not be allowed to enter water areas. These waste waters shall be collected and placed in retention ponds where suspended material can be settled out or the water evaporates so that pollutants are separated from the water.

3.2.2 Stream Crossings

Stream crossings shall be controlled during construction. Crossings shall provide movement of materials or equipment which do not violate water pollution control standards of the Federal, State or local government.

3.2.3 Monitoring

Monitoring of Water Areas Affected by Construction Activities shall be the responsibility of the Contractor. All water areas affected by construction activities shall be monitored by the Contractor.

3.2.4 Water Quality Requirement

The Contractor shall be responsible for meeting all water quality requirements, in accordance with State and Regional Water Quality Control Board regulations.

3.3 PROTECTION OF FISH AND WILDLIFE RESOURCES

The Contractor shall keep construction activities under surveillance, management and control to minimize interference with, disturbance to and damage of fish and wildlife. Species that require specific attention along with measures for their protection will be listed by the Contractor prior to beginning of construction operations.

3.4 PROTECTION OF AIR RESOURCES

The Contractor shall keep construction activities under surveillance, management and control to minimize pollution of air resources. All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with the State of Arizona, Maricopa County and all Federal emission and performance laws and standards. Special management techniques as set out below shall be implemented to control air pollution by the construction activities which are included in the contract.

3.4.1 Particulates

Dust particles, aerosols, and gaseous by-products from all construction activities, processing and preparation of materials, such as from asphaltic batch plants, shall be controlled at all times, including weekends, holidays and hours when work is not in progress. Any permits required shall be obtained by the Contractor. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards mentioned in the paragraph: PROTECTION OF AIR RESOURCES to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times. The Contractor must have sufficient competent equipment available to accomplish this task. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

3.4.2 Hydrocarbons and Carbon Monoxide

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

3.4.3 Odors

Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

3.4.4 Monitoring Air Quality

Monitoring of air quality shall be the responsibility of the Contractor. All air areas affected by the construction activities shall be monitored by the Contractor.

3.5 PROTECTION OF SOUND INTRUSIONS

The Contractor shall keep construction activities under surveillance, and control to minimize damage to the environment by noise. The Contractor shall use methods and devices to control noise emitted by equipment to acceptable levels.

3.6 BURNING RUBBISH AND DEBRIS

Opening burning of rubbish, debris, and other combustibles will not be permitted.

3.7 TESTS

The Contractor shall establish and maintain quality control for environmental protection operations to assure compliance with contract requirements and maintain records of his quality control for all construction operations, including, but not limited to the following items. The Contractor shall record on daily reports any problems in complying with laws, regulations and ordinances and corrective action taken. Three copies of these records and tests, as well as the records of corrective action taken, shall be furnished the Government as directed by the Contracting Officer.

3.7.1 Laws, Regulations and Ordinances

The Contractor must comply with all Federal, State, and local laws, regulations and ordinances concerning pollution control.

3.7.2 Protection of Land Resources

The Contractor shall prevent landscape defacement and provide post-construction clean-up.

3.7.3 Protection of Water Resources

The Contractor shall prevent the contamination of lakes, ditches, or other bodies of water with harmful chemicals; the Contractor shall dispose of waste materials; and the Contractor shall provide erosion control.

3.7.4 Pollution Control Facilities

The Contractor shall provide for the maintenance of pollution control facilities. The Contractor shall conduct a training course on the maintenance of pollution control facilities.

3.8 INSPECTION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action as may be approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions will be granted or costs or damages allowed to the Contractor for any such suspension.

3.9 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be in accordance with the plans submitted for approval by the Contracting Officer.

3.10 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain all constructed facilities and temporary pollution control devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.11 TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL

The Contractor shall train his personnel in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities (vegetative covers and instruments required for monitoring purposes) to insure adequate and continuous environmental pollution control.

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SECTION 01440

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(1988) Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(1990) Use in the Evaluation of Testing and Inspection Agencies as Used in Construction

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause entitled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both on-site and off-site, and shall be keyed to the proposed construction sequence.

3.2 QUALITY CONTROL PLAN

3.2.1 General

The Contractor shall furnish for review by the Government, not later than 30 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause entitled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 15 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the

particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

3.2.2 Content of the CQC Plan

The CQC plan shall include, as a minimum, the following to cover all construction operations, both on-site and off-site, including work by subcontractors, fabricators, suppliers and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC system manager who shall report to the project manager or someone higher in the Contractor's organization. Project manager in this context shall mean the individual with responsibility for the overall management of the project including quality and production.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities and responsibilities. Copies of these letters will also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off-site fabricators, suppliers and purchasing agents. These procedures shall be in accordance with SECTION: SUBMITTAL PROCEDURES.

e. Control, verification and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the

specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the QC plan, the Contractor shall notify the Contracting Officer in writing a minimum of seven calendar days prior to any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the Quality Control Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both on-site and off-site work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 CQC System Manager

The Contractor shall identify an individual within his organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. This CQC System Manager shall be on the site at all times during construction and will be employed by the Contractor, except as noted in the following. An alternate for the CQC System Manager will be identified in the plan to serve in the event of the system manager's absence.

3.4.2 CQC Organizational Staffing

The Contractor shall provide a CQC staff which shall be at the site of work at all times during progress, with complete authority to take any action necessary to ensure compliance with the contract.

3.4.2.1 CQC Staff

Following are the minimum requirements for the CQC staff. These minimum requirements will not necessarily assure an adequate staff to meet the CQC requirements at all times during construction. The actual strength of the CQC staff may vary during any specific work period to cover the needs of the work period. When necessary for a proper CQC organization, the Contractor will add additional staff at no cost to the Government. This listing of minimum staff in no way relieves the Contractor of meeting the basic requirements of quality construction in accordance with contract requirements. All CQC staff members shall be subject to acceptance by the Contracting Officer.

3.4.2.2 CQC System Manager

The CQC system manager shall be an experienced construction person in the area of related work. The CQC system manager shall be assigned as system manager but may have duties as project superintendent in addition to quality control.

3.4.2.3 Supplemental Personnel

A staff shall be maintained under the direction of the CQC system manager to perform all QC activities. The staff must be of sufficient size to ensure adequate QC coverage of all work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities and must be allowed sufficient time to carry out these responsibilities. The QC plan will clearly state the duties and responsibilities of each staff member.

3.4.3 Organizational Changes

The Contractor shall obtain Contracting Officer's acceptance before replacing any member of the CQC staff. Requests shall include the names, qualifications, duties, and responsibilities of each proposed replacement.

3.5 SUBMITTALS

Submittals shall be as specified in SECTION: SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. The controls shall be adequate to cover all construction operations, including both on-site and off-site fabrication, and will be keyed to the proposed construction sequence. The controls shall include at least three phases of control to be conducted by the CQC system manager for all definable features of work, as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work and shall include:

a. A review of each paragraph of applicable specifications.

b. A review of the contract plans.

c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. A check to assure that provisions have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawing or submitted data, and are properly stored.

g. A review of the appropriate activity hazard analysis to assure safety requirements are met.

h. Discussion of procedures for constructing the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that phase of work.

i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. The Government shall be notified at least 24 hours in advance of beginning any of the required action of the preparatory phase. This phase shall include a meeting conducted by the CQC system manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC system manager and attached to the daily QC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

a. A check of preliminary work to ensure that it is in compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verification of full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with sample panels is appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC system manager and attached to the daily QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work on-site, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure continuing compliance with contract requirements, including control testing, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon or conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases may be conducted on the same definable features of work as determined by the Government if the quality of on-going work is unacceptable; or if there are changes in the applicable QC staff or in the on-site production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform tests specified or required to verify that control measures are adequate to provide a product which conforms to contract requirements. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. A list of tests to be performed shall be furnished as a part of the CQC plan. The list shall give the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of test, and an estimate of the number of tests required. The Contractor shall perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

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

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Results of all tests taken, both passing and failing tests, will be recorded on the Quality Control report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. Actual test reports may be submitted later, if approved by the Contracting Officer, with a reference to the test number and date taken. An information copy of tests performed by an off-site or commercial test facility will be provided directly to the Contracting Officer. Failure to submit timely test reports, as stated, may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of $675.00 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7.3 On-Site Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

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

For delivery by mail:

Director
South Pacific Division Laboratory
U.S. Army Corps of Engineers
P.O. Box 37
Sausalito, CA 94966

For other deliveries: Director
South Pacific Division Laboratory
U.S. Army Corps of Engineers
25 Liberty Ship Way
Sausalito, CA 94965

Coordination for each specific test, exact delivery location and dates will be made through the Area Office.

3.8 COMPLETION INSPECTION

At the completion of all work or any increment thereof established by a completion time stated in the Special Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC system manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved plans and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph: DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. The CQC system manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected and so notify the Government. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time stated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

3.9 DOCUMENTATION

The Contractor shall maintain current records of quality control operations, activities, and tests performed, including the work of subcontractors and suppliers. These records shall be on an acceptable form and shall include factual evidence that required quality control activities and/or tests have been performed, including but not limited to the following:

a. Contractor/subcontractor and their area of responsibility.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed today, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and/or control activities performed with results and references to specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.

e. Material received with statement as to its acceptability and storage.

f. Identify submittals reviewed, with contract reference, by whom, and action taken.

g. Off-site surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. List instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

k. These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every seven days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC system manager. The report from the CQC system manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

3.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor at the site of the work, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

3.11 CONTRACTOR PREPARED NETWORK ANALYSIS SYSTEM (NAS) ER 1-1-11 (MAR 1990)

3.11.1 General

The progress chart to be prepared by the Contractor pursuant to the General Clause entitled "SCHEDULE FOR CONSTRUCTION CONTRACTS", listed in SECTION: CONTRACT CLAUSES shall consist of a network analysis system (NAS) as described below. The scheduling of construction is the responsibility of the Contractor and contractor management personnel shall actively participate in development of the network logic diagram so that intended sequences and procedures are clearly understood. The Contractor shall provide the NAS in either Arrow Diagram Method (ADM) or precedence (PDM) format. The network diagram required at the initial schedule submission shall depict the order and interdependence of activities and the method by which the work is to be accomplished. Conditions of submittal are:

a. The diagram shall show a continuous activity flow from left to right. The activity or event numbers, description, duration, and value shall be shown on the diagram.

b. Dates shall be shown on the diagram for start of the project, any milestones required by the contract, and contract Completion.

c. The critical path shall be clearly identified.

d. Submittal, review, procurement, fabrication, delivery, installation, start-up, and testing of special or long lead-time materials and equipment shall be included in the NAS diagram.

e. Government and other agency activities shall be shown. These include but are not limited to: Notice to Proceed, approvals, inspections, and utility tie in for phasing requirements.

3.11.2 Preliminary Network Diagram

A preliminary network diagram, defining the Contractor's planned operations for the first 60 days shall be provided within 14 calendar days after Notice to Proceed is acknowledged. The approved preliminary schedule shall be used for payment not to exceed 60 days after Notice to Proceed.

3.11.3 Initial NAS

The initial NAS shall be submitted within 40 calendar days after Notice to Proceed. It shall provide (1) a reasonable sequence of activities which represent work through the entire project and (2) a reasonable level of activity detail. The schedule interval shall extend from Notice to Proceed through the contract duration specified in "COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK", listed in SECTION: SPECIAL CLAUSES, to contract completion date. Completion of the last activity in the schedule shall be constrained by the contract completion date such that if the projected finish of the last activity falls after the contract completion, then the float calculation shall reflect negative float. Interim milestone dates specified shall be so constrained also. Progress payments will be withheld until the Contractor submits an approvable schedule.

3.11.4 Submittals

The Contractor shall submit a reproducible and two copies of the network diagram at the initial submittal and three copies of the specified reports at the initial and every monthly update throughout the life of the project. The format of the reports shall contain: Activity Number(s), Activity description, Original Duration, Remaining Duration, Early Start date, Late Start date, Early Finish date, Late Finish date, and Total Float. Precedence schedule reports shall include and display preceding and succeeding activities. Cost and/or Earned Value reports shall contain Estimated Earned Value, Percent Complete (based on cost), and Earnings to Date. Report formats are as follow:

a. Logic Report: This report shall list all activities sorted according to activity number. Activities shall be printed in ascending order of activity number. Any standard report which lists all activities including restraints in this manner is acceptable.

b. Criticality Report: This report shall list all activities sorted in ascending order of total float. Activities which have equal values of total float shall be listed in ascending order of Early Starts.

c. Cost or Earned Value Report: This report shall compile Contractors total earned value on the project from the Notice to Proceed until the most recent monthly progress meeting based on agreed progress between the Contractor and the Contracting Officer. Provided that the Contractor has submitted a complete schedule update, this report shall serve as the basis for determining Contractor payment. Activities shall be sorted by activity number(s). This report shall subtotal, all activities in a bid item and provide a bid item percent complete and then total all bid items to provide a total project percent complete.

d. Other sorted reports or curves may be required as project requirements dictate, however, the total number should be limited.

3.11.5 Meetings

A monthly meeting shall be conducted on site attended by the Contractor's project manager and appropriate Contracting Officer's representatives. During this meeting the Contractor will describe, on an activity be activity basis, all proposed revisions and adjustments to the NAS required to reflect the current status of the project. The Contracting Officer's, representative shall approve activity progress, proposed revisions and adjustments, and the use of any optional calculations. The following shall be addressed:

a. The actual start and actual finish dates for all activities in progress or completed as appropriate.

b. The estimated remaining duration for each activity in progress. Progress calculations must be based on remaining duration for each activity and be in an approved calculation mode.

c. The earned value for each activity started but not completed. Payment shall be based on cost of completed activities plus cost to date of in progress activities.

d. All logic changes pertaining to change orders on which a Notice to Proceed has been issued, Contractor proposed changes in activity sequence or durations, and corrections to schedule logic to avoid out of sequence progress.

3.11.6 NAS Updates

Following the monthly progress meeting, a complete update of the NAS based on the approved progress, revisions, and adjustments agreed upon at the meeting shall be computed and submitted not later than 5 working days after the meeting. This update shall be subject to approval of the accurate entry of information agreed upon at the meeting. Actual starts and finishes, remaining duration, or percent complete shall not be automatically updated by default dates contained in many CPM scheduling software systems, except that early start for an activity which could start prior to the update but has no actual start shall default to the data date of the update. Activities which have posted progress without predecessor activities being completed

revisions must clearly display that the Contractor has used in full all available float time for the work involved with the request. Actual delays that are found to be caused by the Contractor's own actions or lack of action, and which result in the extension of the projected contract completion date shall not be a case for extension of the contract completion date. The Contracting Officer may find cause to extend the contract completion date under the contract in the absence of a request by the Contractor when, in the Contracting Officer's judgement, it is equitable.

3.11.10 Available Float

Float available in the schedule at any time shall not be considered as for exclusive use by either the Contractor or the Government. Extensions of time for performance of work required under Contract Clauses entitled, "CHANGES", "DIFFERING SITE CONDITIONS", "DEFAULT (FIXED PRICE CONSTRUCTION)", or "SUSPENSION OF WORK" will be granted only to the extent that equitable time adjustments for affected activities exceed the total float along their paths.

3.11.11 Data Exchange

A data disc shall be provided as required by Clause, "Data Exchange Format." The automated scheduling system utilized by the Contractor shall be capable of providing all requirements of this specification. As many data disc(s) as required by the Contracting Officer shall be provided with the Initial schedule, Monthly Updates, and all NAS revisions or requests for revision. Refer to paragraph: Data Exchange Format for a complete description of this format.

3.12 DATA EXCHANGE FORMAT

3.12.1 General

3.12.1.1 Application of this provision: The data exchange format provides a platform for exchanging scheduling and planning data between various software systems. This section shall be used in conjunction with paragraph: CONTRACTOR PREPARED NETWORK ANALYSIS SYSTEM. The Data Exchange Format shall allow project management systems to share information with other programs. Scheduling information shall be transferred from the Contractor's project management system to the Government as described in this section.

3.12.1.2 Electronic Data Exchange File Required for All Schedule Submissions:

a. The Contractor shall provide schedule data in the Data Exchange Format for each Preliminary, Initial, Monthly NAS Updates, and requests for time extensions or change proposals. The Contractor's failure to provide schedule data in the exact format described herein shall result in disapproval of the entire schedule submission.

b. The entire set of schedule data shall be transferred at every exchange of scheduling data. Thus, for updates to existing projects, the data exchange file shall contain all activities that have not started or are already complete as well as those activities in progress.

3.12.1.3 Data Transfer Responsibility: The Contractor shall be responsible for Electronic Data Exchange File data that may have been lost or destroyed during transit between the Contractor and the Contracting Officer. If Electronic Data Exchange File

data is damaged during transit, then the contractor shall provide the Contracting Officer with a new Electronic Data Exchange File within two (2) working days of notification by the Contracting Officer.

3.12.1.4 Data Consistency Responsibility: The contractor shall be responsible for the consistency between the Electronic Data Exchange File and printed reports which accompany schedule submissions. If Electronic Data Exchange File data for a schedule submission differs, in any way, from the printed schedule reports or standard activity coding, then the Contracting Officer shall disapprove the entire schedule submission. The contractor shall provide the Contracting Officer with a completely revised, and consistent, schedule submission within 24 hours of notification of inconsistency by the Contracting Officer.

3.12.1.5 Creating the Electronic Data Exchange File: The Contractor shall have the option of creating the electronic data exchange file by one of the three following methods:

a. Commercially Available Software: The Contractor shall be required to secure software that meets this requirement. Many commercially available scheduling systems support the standard data exchange format.

b. Interface Program: Under this option the Contractor shall produce his own data translation software. This software shall take the information provided by the Contractor's scheduling system and reformat the data into the Data Exchange Format.

c. Manual Methods: Under this option the Contractor shall manually reformat his scheduling system report files or create all necessary data by manually entering all data into the Data Exchange Format.

3.12.2 General Data Exchange File Requirements

3.12.2.1 File Transfer Medium: All required data shall be submitted on 5-1/4" diskette(s), formatted to hold 360 KB of data, under the MS-DOS Version 2.0 (or higher) operating system. Higher data densities and other operating systems may be approved by the Contracting Officer if compatible with the Government's computing capability.

3.12.2.2 File Type and Format: The data file shall consist of a 132 character, fixed format, "ASCII" file. Text shall be left-justified and numbers shall be right-justified in each field. Data records must conform, exactly, to the sequence, column position, maximum length, mandatory values, and field definitions described below to comply with this standard data exchange format. Unless specifically stated, all numbers shall be whole numbers. All data columns shall be separated by a single blank column.

3.12.2.3 Electronic Data Exchange File Name: The Contractor shall insure that each file has a name related to either the schedule data date, project name, or contract number. No two Electronic Data Exchange Files shall have the same name throughout the life of this contract. The Contractor shall submit his file naming convention to the Contracting Officer for approval. In the event that the Contractor's naming convention is disapproved, the Contracting Officer shall direct the Contractor to provide files under a unique file naming convention.

3.12.2.4 Disc Label: The Contractor shall affix a permanent exterior label to each diskette submitted. The label shall contain the type of schedule (Preliminary, Initial, Update, or Change), full project number, project name, project location, data date, name and telephone number of the contractor's scheduler, and the MS-DOS version used to format the diskette.

3.12.2.5 Standard Activity Coding Dictionary: The Contractor shall submit, with the initial schedule submission, a consistent coding scheme that shall be used throughout the project for the Activity Codes shown in paragraph 3.12.3.2.e. of this section. The coding scheme submitted shall demonstrate that each code shall only represent one type of information through the duration of the contract. Incomplete coding of activities or an incomplete coding scheme shall be sufficient for disapproval of the schedule.

3.12.3 Data Format

3.12.3.1 Data Exchange File Format Organization: The Data Exchange File Format shall consist of the following records provided in the exact sequence shown below:

Paragraph Reference	Record Description	Remarks
3.12.3.2a.	Volume Record	First Record on Every Data Disk
3.12.3.2b.	Project ID Record	Second Record
3.12.3.2c.	Calendar Record(s)	Minimum of One Record Required
3.12.3.2d.	Holiday Record(s)	Optional Record
3.12.3.2e.	Activity Record(s)	Mandatory Record
3.12.3.2f.	Precedence Records	Mandatory for Precedence Method
3.12.3.2g.	Unit Cost Record(s)	Optional for Unit Cost Projs.
3.12.3.2h.	Progress Record(s)	Mandatory for Updates
3.12.3.2i.	File End Record	Last Record of Data File

3.12.3.2 Record Descriptions:

a. Volume Record: The volume Record shall be used to control the transfer of data that may not fit on a single disk. The first record in every disk used to store the data exchange file shall contain the Volume Record. The Volume Record shall sequentially identify the number of the data transfer disk(s). The Volume Record shall have the following format:

Description	Column Position	Max. Len.	Reqd. Value	Type	Just.
RECORD IDENTIFIER	1- 4	4	VOLM	Fixed	
DISK NUMBER	6- 7	2	-	Number	Right

(1) The RECORD IDENTIFIER is the first four characters of this record. The required value for this field shall be "VOLM".

(2) The DISK NUMBER field shall identify the number of the data disk used to store the data exchange information. If all data may be contained on a single disk, this field shall contain the value of "1". If more disks are required, then the second disk shall contain the value "2", the third disk shall be designated with a

"3", and so on. Identification of the last data disk shall not be accomplished with the Volume Record. Identification of the last data disk is accomplished in the PROJECT END RECORD (see paragraph 3.12.3.2.i.).

b. Project ID Record: The Project ID Record is the second record of the file and shall contain project information in the following format:

Description	Column Position	Max. Len.	Reqd. Value	Type	Just.
RECORD IDENTIFIER	1- 4	4	PROJ	Fixed	
DATA DATE	6- 12	7	-	ddmmyy	See (2)
PROJECT IDENTIFIER	14- 17	4	-	Alpha.	Left
PROJECT NAME	19- 66	48	-	Alpha.	Left
CONTRACTOR NAME	68- 103	36	-	Alpha.	Left
ARROW OR PRECEDENCE	105	1	A, P	Fixed	
CONTRACT NUMBER	107-112	6	-	Alpha.	Left
PROJECT START	114-120	7	-	ddmmyy	Filled
PROJECT END	122-128	7	-	ddmmyy	Filled

(1) The RECORD IDENTIFIER is the first four characters of this record. The required value for this field shall be "PROJ". This record shall contain the general project information and indicates which scheduling method shall be used.

(2) The DATA DATE is the date of the schedule calculation. The abbreviation "ddmmyy" refers to a date format that shall translate a date into two numbers for the day, three letters for the month, and two numbers for the year. For example, March 1, 1999 shall be translated into 01Mar99. This same convention for date formats shall be used throughout the entire data format. To insure that dates are translated consistently, the following abbreviations shall be used for the three character month code:

Abbreviation	Month
JAN	January
FEB	February
MAR	March
APR	April
MAY	May
JUN	June
JUL	July
AUG	August
SEP	September
OCT	October
NOV	November
DEC	December

(3) The PROJECT IDENTIFIER is a maximum of four character abbreviation for the schedule. These four characters shall be used to uniquely identify the project and specific update as agreed upon by the Contractor and Contracting Officer. When utilizing scheduling software these four characters shall be used to select the project. Software manufacturers' shall verify that data importing programs do not automatically overwrite other schedules with the same PROJECT IDENTIFIER.

(4) The PROJECT NAME field shall contain the name and location of the project edited to fit the space provided. The data appearing here shall appear on scheduling software reports. The abbreviation "Alpha.", used throughout paragraph six, RECORD DESCRIPTIONS, refers to an "Alphanumeric" field value.

(5) The CONTRACTOR NAME field shall contain the construction Contractor's name edited to fit the space provided.

(6) The ARROW OR PRECEDENCE field shall indicate which method shall be used for calculation of the schedule. The value "A" shall signify the Arrow Diagramming technique. The value "P" shall signify the Precedence Diagramming technique. The ACTIVITY IDENTIFICATION field of the Activity Record shall be interpreted differently depending on the value of this field (see paragraph 3.12.3.2.e.2.). The Precedence Record shall be required if the value of this field is "P" (see paragraph 3.12.3.2.f.).

(7) The CONTRACT NUMBER field shall directly identify the contract for the project. For example, a complete government construction contract number, "DACA09-92-C-0001", shall be entered into this field as "920001".

(8) The PROJECT START shall contain the date that the project will start or has started. On government construction projects, this date is the date that the construction contractor acknowledges the Notice to Proceed.

(9) The PROJECT END shall contain the date that the contract must complete on or prior to. On government construction projects, this date is the PROJECT START plus the contract period, typically expressed in a specific number of calendar days.

c. Calendar Record: The Calendar Record(s) shall follow the Project Identifier Record in every data file. A minimum of one calendar Record shall be required for all data exchange activity files. The format for the Calendar Record shall be as follows:

Description	Column Position	Max. Len.	Reqd. Value	Type	Just.
RECORD IDENTIFIER	1- 4	4	CLDR	Fixed	
CALENDAR CODE	6- 6	1	-	Alpha.	Filled
WORKDAYS	8- 14	7	SMTWTFS	See (3)	
CALENDAR DESCRIPTION	16- 45	30	-	Alpha.	Left

(1) The RECORD IDENTIFIER shall always begin with "CLDR" to identify it as a Calendar Record. Each Calendar Record used shall have this identification in the first four columns.

(2) The CALENDAR CODE shall be used in the activity records to signify that this calendar is associated with the activity.

(3) The WORKDAYS field shall contain the work-week pattern selected with "Y", for Yes, and "N", for No. The first character shall be Sunday and the last character Saturday. An example of a typical five (5) day work-week would be NYYYYYN. A seven (7) day work-week would be YYYYYYY.

(4) The CALENDAR DESCRIPTION shall be used to briefly explain the calendar used.

d. Holiday Record:

Optional Holiday Record(s) shall follow the Calendar Record(s). The Holiday Record shall be used to designate specific non-work days for a specific Calendar. More than one Holiday Record may be used for a particular calendar. If used, the following format shall be followed:

Description	Column Position	Max. Len.	Reqd. Value	Type	Just.
RECORD IDENTIFIER	1- 4	4	HOLI	Fixed	
CALENDAR CODE	6- 6	1	-	Alpha.	Filled
HOLIDAY DATE	8- 14	7	-	ddmmyy	Filled
HOLIDAY DATE	16- 22	7	-	ddmmyy	Filled
HOLIDAY DATE	24- 30	7	-	ddmmyy	Filled
HOLIDAY DATE	32- 38	7	-	ddmmyy	Filled
HOLIDAY DATE	40- 46	7	-	ddmmyy	Filled
HOLIDAY DATE	47- 54	7	-	ddmmyy	Filled
HOLIDAY DATE	56- 62	7	-	ddmmyy	Filled
HOLIDAY DATE	64- 70	7	-	ddmmyy	Filled
HOLIDAY DATE	72- 78	7	-	ddmmyy	Filled
HOLIDAY DATE	80- 86	7	-	ddmmyy	Filled
HOLIDAY DATE	88- 94	7	-	ddmmyy	Filled
HOLIDAY DATE	96-112	7	-	ddmmyy	Filled
HOLIDAY DATE	114-120	7	-	ddmmyy	Filled
HOLIDAY DATE	122-128	7	-	ddmmyy	Filled

(1) The RECORD IDENTIFIER shall always begin with "HOLI" and shall signify an Optional Holiday Calendar is to be used.

(2) The CALENDAR CODE indicates which work-week calendar the holidays shall be applied to. More than one HOLI record may be used for a given CALENDAR CODE.

(3) The HOLIDAY DATE is to be used for each date to be designated as a non-work day.

e. Activity Records: Activity records shall follow any Holiday Record(s). If there are no Holiday Record(s), then the Activity Records shall follow the Calendar Record(s). There shall be one Activity Record for every activity in the network. Each activity shall have one record in the following format:

Description	Column Position	Max. Len.	Reqd. Value	Type	Just.
RECORD IDENTIFIER	1- 4	4	ACTV	Fixed	
ACTIVITY IDENTIFICATION	6- 15	10	-	See (2)	
ACTIVITY DESCRIPTION	17- 46	30	-	Alpha.	Left
ACTIVITY DURATION	48- 50	3	-	Integer	Right
ACTIVITY COST	52- 60	9	-	Integer	Right
CONSTRAINT DATE	62- 68	7	-	ddmmyy	Filled

Description	Column Position	Max. Len.	Reqd. Value	Type	Just.
CONSTRAINT TYPE	70- 71	2	-	See (7)	
CALENDAR CODE	73- 73	1	-	Alpha.	Filled
HAMMOCK CODE	75- 75	1	Y,blank	Fixed	
WORKERS PER DAY	77- 79	3	-	Integer	Right
RESPONSIBILITY CODE	81- 84	4	-	Alpha.	Left
WORK AREA CODE	86- 89	4	-	Alpha.	Left
MOD OR CLAIM NUMBER	91- 94	4	-	Alpha.	Left
BID ITEM	96- 99	4	-	Alpha.	Left
CSI CODE	101-105	5	-	See (15)	
USER DEFINED 1	107-110	4	-	See (16)	
USER DEFINED 2	112-115	4	-	See (16)	
USER DEFINED 3	117-120	4	-	See (16)	
USER DEFINED 4	122-125	4	-	See (16)	
USER DEFINED 5	127-130	4	-	See (16)	

(1) The RECORD IDENTIFIER for each activity description record must begin with the four character "ACTV" code. This field shall be used for both the Arrow Diagram Method (ADM) and Precedence Diagram Method (PDM) (see paragraph 3.12.3.2.b.6.).

(2) The ACTIVITY IDENTIFICATION consists of coding that differs, depending on whether the ADM or PDM method was selected in the Project Record (see paragraph 3.12.3.2.b.6.). If the ADM method was selected, then the field shall be interpreted as two right-justified fields of five (5) integers each. If the PDM method was selected, the field shall be interpreted as one (1) right-justified field of ten (10) integers each. The maximum activity number allowed under this arrangement is 99,999 for ADM and 9,999,999,999 for the PDM method.

(3) The ACTIVITY DESCRIPTION shall be a maximum of 30 characters. Descriptions must be limited to the space provided.

(4) The ACTIVITY DURATION contains the estimated duration for the activity on the schedule. The duration shall be based upon the work-week designated by the activity's related calendar (referenced in 3.12.3.2.e.8.).

(5) The ACTIVITY COST contains the estimated earned value of the work to be accomplished in the activity.

(6) The CONSTRAINT DATE field shall be used to identify a date that the scheduling system may use to modify float calculations. If there is a date in this field, then there must be a valid entry in the CONSTRAINT TYPE field. The CONSTRAINT DATE shall be the same as, or later than, the PROJECT START DATE. The CONSTRAINT DATE shall be the same as, or earlier than, the PROJECT END DATE.

(7) The CONSTRAINT TYPE field shall be used to identify the way that the scheduling system shall use the CONSTRAINT DATE to modify schedule float calculations. If there is a value in this field, then there must be a valid entry in the CONSTRAINT DATE field. Below are the minimum list of entries for the CONSTRAINT TYPE. Other types may be available from specific software manufacturers.

Code	Definition
ES	The CONSTRAINT DATE shall replace an activity's early start date, if the early start date is prior to the CONSTRAINT DATE.
LF	The CONSTRAIN DATE shall replace an activity's late finish date, if the late finish date is after the CONSTRAINT DATE.

(8) The CALENDAR CODE, as previously explained, relates this activity to an appropriate work-week calendar. The ACTIVITY DURATION must be based on the valid work-week referenced by this CALENDAR CODE field (see paragraph 3.12.3.2.e.4.).

(9) The HAMMOCK CODE indicates that a particular activity does not have its own independent duration, but takes its start dates from the start date of the preceding activity (or node) and takes its finish dates from the finish dates of its succeeding activity (or node). If the value of the HAMMOCK ACTIVITY field is "Y", then the activity is a HAMMOCK ACTIVITY.

(10) The WORKERS PER DAY is an optional field that shall be specified at the discretion of the Field Operating Agency (FOA). This field shall contain the average number of workers expected to work on the activity each day the activity is in progress. The total duration times the average number of workers per day shall equal the Contractor's estimate of the total man days of work required to perform the activity.

(11) The RESPONSIBILITY CODE shall identify the Subcontractor or major trade involved with completing the work for the activity.

(12) The WORK AREA CODE shall identify the location of the activity within the project.

(13) The MOD OR CLAIM NUMBER code is an optional field that shall be specified at the discretion of the Field Operating Agency (FOA). This code shall uniquely identify activities that are changed on a construction contract modification, or activities that justify any claimed time extensions.

(14) The BID ITEM field is an optional field that shall be specified at the discretion of the Field Operating Agency (FOA). This field shall designate the bid item number associated with the activity.

(15) The Construction Specification Institute Masterformat CSI CODE is an optional field that shall be specified at the discretion of the Field Operating Agency (FOA). The CSI CODE shall contain the value of code corresponding to the work to be accomplished in this activity.

(16) USER DEFINED fields are optional and not required to meet the data exchange standard. They are provided to allow for a fixed expansion of capabilities for individual very large projects that may require additional fields.

f. Precedence Record: The precedence Record(s) shall follow the Activity Records if a Precedence Type Schedule (PDM) is identified in the ARROW OR PRECEDENCE field of the Project Record (see paragraph 3.12.3.2.b.6.). The Precedence Record has the following format:

Description	Column Position	Max. Len.	Reqd. Value	Type	Just.
RECORD IDENTIFIER	1- 4	4	PRED	Fixed	
ACTIVITY IDENTIFICATION	6- 15	10	-	Integer	See (2)
PRECEDING ACTIVITY	17- 26	10	-	Integer	
PREDECESSOR TYPE	28- 29	2	-	See (4)	
LAG DURATION	31- 34	4	-	Integer	Right

(1) The RECORD IDENTIFIER shall begin with the four character "PRED" in the first four columns of the record.

(2) The ACTIVITY IDENTIFICATION identifies the activity whose predecessor shall be specified in this record. Refer to the Activity Record for further explanation on this field (see paragraph 3.12.3.2.e.2.).

(3) The PREDECESSOR Activity number is the number of an activity that precedes the activity noted in the ACTIVITY IDENTIFICATION field.

(4) The PREDECESSOR TYPE field indicates the type of relationship that exists between the chosen pair of activities. The PREDECESSOR TYPE field must, as a minimum, contain one of the codes listed below. Other types of activity relations may be supported from specific software vendors.

Code	Definition
SS	Start-to-Start relationship
FF	Finish-to-Finish relationship
FS	Finish-to-Start relationship

(5) The LAG DURATION field contains the number of days delay between the preceding and current activity.

g. Unit Cost Record: The Unit Cost Record shall follow all Precedence Records. If the schedule utilizes the Arrow Diagram Method, then the Unit Cost Record shall follow any Activity Records. The fields for this record shall take the following format:

Description	Column Position	Max. Len.	Reqd. Value	Type	Just.
RECORD IDENTIFIER	1- 4	4	UNIT	Fixed	
Activity IDENTIFICATION	6- 15	10	-	Integer	See (2)
TOTAL QTY	17- 27	11	-	Floating Pt.	
COST PER UNIT	29- 39	11	-	Floating Pt.	
QTY TO DATE	41- 51	11	-	Floating Pt.	
UNIT OF MEASURE	53- 55	3	-	Alpha.	

(1) The RECORD IDENTIFIER shall be identified with the four character "UNIT" placed in the first four columns of the record.

(2) The ACTIVITY IDENTIFICATION for each activity shall match the format described in the activity record (see paragraph 3.12.3.2.e.2.).

(3) The TOTAL QTY is the total amount of this type of material to be used in this activity. This number consists of eight digits, one decimal point, and two more digits. An example of a number in this format is "11111111.11". If decimal places are not needed, this field shall still contain a ".00" in columns 25, 26, and 27.

(4) The COST PER UNIT is the cost, in dollars and cents, for each unit to be used in this activity. This number consists of eight digits, one decimal point, and two more digits. An example of a number in this format is "11111111.11". If decimal places are not needed, this field shall still contain a ".00" in columns 37, 38, and 39.

(5) The QTY TO DATE is the quantity of material installed in this activity up to the data date. This number consists of eight digits, one decimal point, and two more digits. An example of a number in this format is "11111111.11". If decimaL places are not needed, this field shall still contain a ".00" in columns 49, 50, and 51.

(6) The UNIT OF MEASURE is an abbreviation that may be used to describe the units being measured for this activity.

h. Progress Record: Progress Record(s) shall follow all Unit Cost Record(s). If there are no unit Cost Record(s), then the progress Record(s) shall follow all Precedence Records. If the schedule utilizes the Arrow Diagram Method, then the Progress Record shall follow any Activity Records. One Record shall exist for each activity in-progress or completed. The fields for this Record shall take the following format:

Description	Column Position	Max. Len.	Reqd. Value	Type	Just.
RECORD IDENTIFIER	1- 4	4	PROG	Fixed	
ACTIVITY IDENTIFICATION	6- 15	10	-	Integer	See (2)
ACTUAL START DATE	17- 23	7	-	ddmmyy	Full
ACTUAL FINISH DATE	25- 31	7	-	ddmmyy	Full
REMAINING DURATION	33- 35	3	-	Integer	Right
COST TO DATE	37- 45	9	-	Integer	Right

(1) The RECORD IDENTIFIER shall begin with the four character "PROG" in the first four columns of the record.

(2) The ACTIVITY IDENTIFICATION for each activity for which progress has been posted, shall match the format described in the Activity Record (see paragraph 3.12.3.2.e.2.).

(3) An ACTUAL START DATE is required for all in-progress activities. The ACTUAL START DATE shall be the same as, or later than, the PROJECT START date contained in the Project Record (see paragraph 3.12.3.2.b.8.). The ACTUAL START DATE

shall also be the same as, or prior to, the DATA DATE contained in the Project Record (see paragraph 3.12.3.2.b.2.).

(4) An ACTUAL FINISH DATE is required for all Completed activities. If the REMAINING DURATION of an activity is zero, then there must be an ACTUAL FINISH DATE. The ACTUAL FINISH DATE must be the same as, or later than the PROJECT START date contained in the Project Record (see paragraph 3.12.3.2.b.8.). The ACTUAL FINISH DATE must also be the same as, or prior to the DATA DATE contained in the Project Record (see paragraph 3.12.3.2.b.2.).

(5) A REMAINING DURATION is required for all in-progress activities. Activities completed, based on time, shall have a zero (0) REMAINING DURATION.

(6) Cost progress is contained in the field COST TO DATE. If there is an ACTUAL START DATE, then there must also be some value for COST TO DATE. The COST TO DATE is not tied to REMAINING DURATION. For example, if the REMAINING DURATION is "0", the COST TO DATE may only be 95% of the ACTIVITY COST. This difference may be used to reflect 5% retainage for punch list items.

i. File End Record:

(1) The File End Record shall be used to identify that the data file is completed. This record shall be the last record of the entire data file. The File End record shall have the following format:

Description	Column Position	Max. Len.	Reqd. Value	Type	Just.
RECORD IDENTIFIER	1- 3	3	END	Fixed	

(2) The RECORD IDENTIFIER for the File End Record shall be "END". No data contained in the data exchange file that occurs after this record is found shall be used.

-- End of Section --

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SITE WORK

SECTION 02210

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SECTION 02210

GRADING

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 (56,000ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2216	(1990) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
ASTM D 2487	(1990) Classification of Soils for Engineering Purposes

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Materials classified in ASTM D 2487 as SC, SM, GC, GM, GW, GP, and SW, and free from roots and other organic matter, trash, debris, and frozen materials and stones larger than 6 inches in any dimension are satisfactory.

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, CL, MH, CH, 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

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

1.2.4 Degree of Compaction

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

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 REMOVAL OF VEGETATION

During the execution of this Section, any plants that obstruct the location of the site improvements shall be removed with their roots and disposed of at the Contractors expense. Removal of any plant larger in any dimension than 5 feet or with a caliper measured at the base of greater than 1-1/2 inches shall be approved by the Contracting Officer.

3.2 EXCAVATION

Excavation of every description, regardless of material encountered, within the grading limits of the project shall be performed to the lines and grades indicated. Satisfactory excavation material shall be transported to and placed in fill areas within the limits of the work. All unsatisfactory material and surplus material shall become the property of the Contractor and shall be removed from site as approved by the Contracting Officer. In the event that it is necessary to remove unsatisfactory material to a depth greater than specified, the Contracting Officer shall be notified and an adjustment in the contract price will be considered in accordance with the contract. Excavations carried below the depths indicated, without specific directions, shall, except as otherwise specified, be refilled to the proper grade with satisfactory material as directed. All additional work of this nature shall be at the Contractor's expense. Excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Excavations shall be kept free from water while construction therein is in progress.

3.3 DITCHES AND GUTTERS

Ditches and gutters shall be cut accurately to the cross sections and grades indicated. All roots, stumps, rock, and foreign matter in the sides and bottom of ditches and gutters shall be trimmed and dressed or removed to conform to the slope, grade, and shape of the section indicated. Care shall be taken not to excavate ditches and gutters below the grades indicated. Excessive ditch and gutter excavation shall be backfilled to grade either with satisfactory, thoroughly compacted material or with suitable stone or cobble to form an adequate gutter paving as directed. All ditches and gutters excavated under this section shall be maintained until final acceptance of the work. Satisfactory material excavated from ditches shall be placed in fill areas. Unsatisfactory and excess excavated material shall be disposed of in accordance with directions in paragraph: EXCAVATION. No excavated material shall be deposited closer to the edges of the ditches than indicated and in no case less than 3 feet.

3.4 BACKFILL ADJACENT TO STRUCTURES

Backfill adjacent to structures shall be placed and compacted uniformly in such manner as to prevent wedging action or eccentric loading upon or against the structures. Slopes bounding or within areas to be backfilled shall be stepped or serrated to prevent sliding of the fill. During backfilling operations and in the formation of embankments, equipment that will overload the structure in passing over and compacting these fills shall not be used. Backfill for storm drains and subdrains, including the bedding and backfill for structures other than culverts and drains, shall conform to the additional requirements in other applicable sections.

3.5 PREPARATION OF GROUND SURFACE FOR FILL

All vegetation, such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish, and other unsatisfactory material within the area upon which fill is to be placed, shall be stripped in accordance with paragraph: Removal of Vegetation or otherwise removed before the fill is started. In no case will unsatisfactory material remain in or under the fill area. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped, or broken up, as directed, in such manner that the fill material will bond with the existing surface. Prepared surfaces on which compacted fill is to be placed shall be wetted or dried as may be required to obtain the specified moisture content and density.

3.6 FILLS AND EMBANKMENTS

Fills and embankments shall be constructed at the locations and to lines and grades indicated. The completed fill shall conform to the shape of the typical sections indicated or shall meet the requirements of the particular case. Satisfactory material obtained during excavation shall be used in forming required fill. Fill shall be satisfactory material and shall be reasonably free from roots, other organic material, and trash and from stones having a maximum diameter greater than 6 inches. No frozen material will be permitted in the fill. Stones having a dimension greater than 4 inches shall not be permitted in the upper 6 inches of fill or embankment. The material shall be placed in successive horizontal layers of 8 inches in loose depth for the full width of the cross section and shall be compacted as specified. Each layer shall be compacted before the overlaying lift is placed. Moisture content of the fill or backfill material shall be adjusted by wetting or aerating, as required, to within plus or minus 3 percent of optimum moisture content as determined from laboratory tests specified in paragraph: DEFINITIONS. Moisture shall be distributed uniformly throughout each loose lift by disking, harrowing or other approval method during placement and compaction.

3.7 COMPACTION

Each layer of the fill or embankment shall be compacted to at least 90 percent of laboratory maximum density.

3.8 FINISHED EXCAVATION, FILLS, AND EMBANKMENTS

All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of

finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified. Ditches and gutters shall be finished to permit adequate drainage. For subgrade areas to be paved, the following shall be accomplished as required: (a) soft or otherwise unsatisfactory material shall be replaced with satisfactory excavated material or other approved materials; (b) rock encountered in the cut sections shall be excavated to a depth of 6 inches below finished grade for the subgrade; (c) low areas resulting from removal of unsatisfactory material or from 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 shall be compacted as specified. The surface of embankments or excavated areas for road construction or other areas on which a base course or pavement is to be placed shall vary not more than 0.05 foot from the established grade and approved cross section. Surfaces other than those that are to be paved shall be finished not more than 0.15 foot above or below the established grade or approved cross section.

3.9 FIELD TESTING CONTROL

Testing shall be the responsibility of the Contractor and shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Field density and moisture content tests shall be performed on every 5000 square feet of each 8-inch lift placed in each contiguous backfill location, or a minimum of one set of tests for each separate location. Adjacent areas which are backfilled in different time frames shall be treated as separate areas and tested according to this paragraph. Field in-place density shall be determined in accordance with ASTM D 1556. Field moisture content shall be determined in accordance with ASTM D 2216.

3.10 PROTECTION

Newly graded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. All work shall be conducted in accordance with the environmental protection requirements of the contract.

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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 C 117	(1990) Materials Finer Than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	(1984a) Sieve Analysis of Fine and Coarse 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 (56,000ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2216	(1990) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
ASTM D 2487	(1990) Classification of Soils for Engineering Purposes

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, abbreviated hereinafter as percent laboratory maximum density.

1.3 SUBMITTALS

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

1.3.1 SD-06, Instructions

Soil Treatment Agent; GA.

Certifications, material safety data sheets and manufacturer's instructions, not less than 7 days before delivery of the soil treatment agent.

1.4 DELIVERY AND STORAGE

Soil treatment agents shall be delivered to the jobiste in sealed and labeled containers bearing the manufacturer's warnings. Delivery, handling and storage shall be performed in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials include materials classified in ASTM D 2487 as GW, GP, SW, SM, SC, GC, and GM shall be free of trash, debris, roots or other organic matter, or stones larger than 6 inches in any dimension.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials include materials classified in ASTM D 2487 as Pt, OH, OL, ML, CL, MH, and CH 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.

2.2 SOIL TREATMENT AGENT

Soil treatment agent shall be either chlorpyrifos, permethrin, fenvalerate, isofenphos or cypermethrin. Labels shall bear evidence of registration under the Federal Insecticide, and Rodenticide Act and shall provide the manufacturers recommended rates of application.

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 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, 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. 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.

3.3 DRAINAGE AND DEWATERING

3.3.1 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 by the Contractor 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.

3.3.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 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 2 feet below the working level.

3.4 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.

3.5 BLASTING

Blasting will not be permitted.

3.6 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.

3.7 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 SECTION: GRADING.

3.8 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking or other erosion resulting from ponding or flow of water.

3.9 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials. The surface shall be scarified to a depth of 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.

3.10 SOIL TREATMENT

Just prior to placing concrete slab on grade and just prior to backfilling around concrete or masonry foundations for structures, soil treatment shall be applied. All pesticide applications shall be made by state licensed and certified pest control personnel and in strict accordance with manufacturer's label instructions. The Contractor shall formulate, treat, store and dispose of the pesticides in accordance with manufacturer's instructions, and both state and Federal regulations.

3.11 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 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 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 95 percent laboratory maximum density. 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.

3.12 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with ASTM D 1556. Field moisture tests shall be determined in accordance in ASTM D 2216.

3.12.1 In-Place Densities

3.12.1.1 In-Place Density of Subgrades

One test per 1,000 square foot or fraction thereof.

3.12.1.2 In-Place Density of Fills and Backfills

One test per 1,000 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 4 feet in width, which are compacted with hand or hand-operated machines shall be tested as follows: One test per each area less than 400 square feet, or one test for each 200 linear foot of long narrow fills 200 feet or more in length.

3.12.2 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material to determine the optimum moisture and laboratory maximum density values. One representative test per 100 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.

3.12.3 Classification of Material

Material shall be classified in accordance with ASTM C 117 and ASTM C 136.

3.13 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.

3.14 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.

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SECTION 02222

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1990) Minerals Finer Than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	(1984a) Sieve Anlaysis of Fine and Coarse 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 (56,000ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2487	(1990) Classification of Soils for Engineering Purposes

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.

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: SUBMITTAL DESCRIPTIONS.

1.3.1 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 SC, GC, SM, GM, SP, 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 PT, OH, CL, ML, 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 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 nonplastic material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the 1-inch sieve. The maximum allowable aggregate size shall be 3 inches, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

2.1.8 Initial Backfill Material

Initial backfill shall consist of select granular material or satisfactory materials free from rocks 3 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, the initial backfill material shall be free of stones larger than 3 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

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. 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. The Contractor shall apply trench bracing, sheathing or shoring as necessary. 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 entire bottom quadrant of each pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 1 inch 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 6 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

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.1.1.6 Stockpiles

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

3.2 BACKFILLING AND COMPACTION

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 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. The trench shall be partially backfilled to 50 percent prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test.

3.2.1.1 Replacement of Unyielding Material

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

3.2.1.2 Replacement of Unstable Material

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

3.2.1.3 Bedding and Initial Backfill

Bedding shall be of the type and thickness shown. 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, shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

a. Sidewalks, Seeded Areas, and Miscellaneous Areas: Backfill shall be deposited in layers of a maximum of 12-inch loose thickness, and compacted to 90 percent maximum density. Water flooding or jetting methods shall not be permitted. This requirement shall also apply to all other areas not specifically designated above.

3.2.1.5 Surface Restoration

All roadways and parking lots broken into or damaged by the new work shall be replaced in kind at no cost to the Government.

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 7 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.3 SPECIAL REQUIREMENTS

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

3.3.1 Water Lines

Depending on the diameter of the waterline, trenches shall be of a depth to provide a minimum cover of 3 or 4 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.3.2 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 C 117 and ASTM C 136 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 2 feet of backfill for every 200 feet of installation shall be performed. Field density tests shall be performed for every 18 inches of backfill for trenches less than 200 feet in length. Field in-place density shall be determined in accordance with ASTM D 1556. 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. Moisture content shall be within 3 percent of optimum moisture content as determined from laboratory tests in paragraph: Definitions.

3.4.4 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to the finished grade surface, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipes 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.

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SECTION 02513

DECOMPOSED GRANITE PATHS AND PAVEMENT

PART 1 GENERAL

1.1 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	(1990) Concrete Aggregate

1.2 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.2.1 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.

PART 2 PRODUCTS

2.1 AGGREGATE BASE COURSE

Aggregate base course shall be clean, crushed angular granite rocks and shall conform to ASTM C 33, Grade 57. Maximum size of aggregate shall be 3/4 inches.

2.2 DECOMPOSED GRANITE

Decomposed granite shall be clean crushed aggregate screenings of decomposed granite, light brown in color. Largest size of aggregate shall be 1/4 inch.

2.3 STABILIZER

Stabilizer shall be colorless, non-toxic, odorless, water activated, organic soil binding product.

2.4 STABILIZED DECOMPOSED GRANITE

Stabilized decomposed granite shall be 10 pounds of stabilizer and 2000 pounds decomposed granite uniformly blended at an approved blending plant.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to aggregate base course placement. Subgrade shall be placed and compacted to conform with applicable requirements of SECTION: GRADING.

3.1.1 Path and Pavement Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of sidewalk and supported between side forms. Grade shall not exceed specified slope by greater than 1/2 inch per 10 linear feet. Side slopes shall be between 1 - 2 percent.

3.1.2 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the aggregate base course is placed.

3.2 AGGREGATE BASE COURSE

Lay down a consistent 3 inch thick layer of aggregate base course. Compact with a minimum 500 pound double drum roller.

3.3 STABILIZED DECOMPOSED GRANITE PLACEMENT

Lay a minimum 3 inch thick surface course of decomposed granite over the geotextile membrane. Avoid having the delivery vehicles drive directly over the base course and geotextile membrane. Level with a gannon, light drag or similar equipment. Water so that moisture penetrates the full 3 inch depth. Compact using a minimum 500 pound double drum roller. Final compacted depth shall be a minimum 3 inches.

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SECTION 02660

WATER LINES

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 88	(1989) Seamless Copper Water Tube
ASTM D 1869	(1978; R 1989) Rubber Rings for Asbestos-Cement Pipe

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(1989) Cast Iron Pipe Flanges and Flanged Fittings

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(1987) Hypochlorites
AWWA B301	(1987; B301a) 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	(1987) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C111	(1990) Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C115	(1988) Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges
AWWA C151	(1986) Ductile-Iron Pipe, Centrifugally Cast and in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

AWWA C153	(1988) Ductile-Iron Compact Fittings, 3 In. Through 6 In. for Water and Other Liquids
AWWA C400	(1980; C400a; R 1986) Asbestos-Cement Distribution Pipe, 4 In. Through 16 In. (100 mm through 400 mm) NPS, for Water and Other Liquids
AWWA C500	(1986) Gate Valves for Water and Sewage Systems
AWWA C504	(1987) Rubber-Seated Butterfly Valves
AWWA C509	(1987) Resilient-Seated Gate Valves for Water and Sewage Systems
AWWA C600	(1987) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C603	(1990) Installation of Asbestos-Cement Pressure Pipe
AWWA C606	(1987) Grooved and Shouldered Joints
AWWA C651	(1986; C651a) Disinfecting Water Mains
AWWA C700	(1990; C700a) Cold-Water Meters-Displacement Type, Bronze Main Case
AWWA C701	(1998) Cold-Water Meters - Turbine Type for Customer Service
AWWA C800	(1989) Underground Service Line Valves and Fittings
AWWA M16	(1978) Work Practices for Asbestos-Cement Pipe

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA-01	(1989, 2nd Ed) Thrust Restraint Design for Ductile Iron Pipe

FEDERAL SPECIFICATIONS (FS)

FS ZZ-H-451	(Rev G) Hose, Fire, Woven-Jacketed Rubber or Latex or Rubber-Coated Fabric-Lined, with Couplings

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	(1987) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 49	(1975) 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

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 21	(1982) White or Colored Silicone Alkyd Paint
SSPC Paint 25	(1982) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)

1.2 GENERAL

This section covers water supply and service lines, and connections to building service at a point approximately 5 feet outside buildings and structures to which service is required.

1.2.1 Piping for Water Service Lines

Piping for water service lines less than 3 inches in diameter shall be copper tubing, unless otherwise shown or specified. Piping for water service lines for sizes 3 inches and larger shall be as indicated on the drawings.

1.2.2 Piping for Water Distribution Lines 3 Inches or Larger

Piping for water distribution lines 3 inches or larger shall be ductile iron, asbestos cement, unless otherwise shown or specified.

1.2.3 Piping for Water Supply Lines 3 Inches or Larger

Piping for water supply lines 3 inches or larger shall be ductile iron, asbestos-cement, unless otherwise shown or specified.

1.2.4 Excavation, Trenching, and Backfilling for Water Lines

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of SECTION: EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified 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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-10, Design Analysis and Calculations; GA.

All calculations shall be submitted to the Contracting Officer for approval.

1.3.2 SD-44, Manufacturer's Instructions; FIO.

The Contractor shall, as a part of the detail drawings, submit to the Contracting Officer the manufacturer's recommendations for each material or procedure to be utilized. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless otherwise directed by the Contracting Officer.

1.3.3 SD-60, Safety Plan; GA.

The method proposed for disposal of waste water from hydrostatic tests and disinfection shall be submitted to the Contracting Officer for approval prior to performing hydrostatic tests.

1.3.4 SD-72, Training Data; FIO.

The manufacturer shall assist the Contractor by training and instructing the Contractor's personnel in proper installation procedures and techniques. Certification will be required in writing from the manufacturer listing the names of those persons so qualified. The manufacturer's representative shall be a person regularly engaged in such service and shall be certified in writing by the manufacturer to be technically qualified and experienced to supervise this training.

1.3.5 SD-76, Certificates of Compliance; GA.

Upon completion of the project and before final acceptance, the Contractor shall deliver to the Contracting Officer a statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in complete accordance with the contract plans and specifications and the manufacturer's prescribed procedures and techniques.

1.3.6 SD-91, Records; FIO.

The Contractor will maintain a chronological record throughout the course of the contract of all uncorrected deficiency items.

1.4 HANDLING

Pipe and accessories shall be handled so as to insure 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. 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 MATERIALS

Materials shall conform to the respective specifications and other requirements specified below.

2.1.1 Pipe

2.1.1.1 Asbestos-Cement Pipe

Asbestos-cement pipe shall conform to AWWA C400, Class 150 for all water lines 16 inches or less, unless otherwise shown or specified. Uncombined calcium hydroxide content shall not exceed 1.0 percent. Asbestos-cement pipe is 12 inches not 3 inches.

2.1.1.2 Copper Tubing

Copper tubing shall conform to ASTM B 88, Type K, annealed.

2.1.1.3 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. When installed underground, pipe shall be encased with 15 mil thick polyethylene in accordance with AWWA C105. Flanged ductile iron pipe with threaded flanges shall be in accordance with AWWA C115.

2.1.2 Joints

2.1.2.1 Asbestos-Cement Pipe

Rubber rings for joints shall conform to ASTM D 1869.

2.1.2.2 Copper Tubing

Joints shall be compression-pattern flared and shall be made with fittings hereinafter specified.

2.1.2.3 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.

2.1.2.4 Connections

Connections between asbestos-cement pipe and cast-iron fittings, valves or hydrants shall be made with jointing materials conforming to AWWA C603.

2.1.3 Fittings and Specials

2.1.3.1 Asbestos-Cement Pipe

Fittings and specials shall be cast iron, bell-end in accordance with AWWA C110, 150 psi pressure rating, except the profile of bell may have special dimensions as required by the pipe manufacturer. Cast-iron fittings and specials shall be cement-mortar lined in accordance with AWWA C104. Linings shall be standard thickness.

2.1.3.2 Copper Tubing

Fittings and specials shall be flared and conform to ASME B16.26.

2.1.3.3 Ductile-Iron Pipe

Fittings and specials 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 in accordance with AWWA C104. Linings shall be standard thickness. Ductile iron compact fittings shall be accordance with AWWA C153.

2.1.4 Valves

2.1.4.1 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 125-pound type conforming to ASME B16.1.

2.1.4.2 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.

2.1.4.3 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 must 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 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.

2.1.4.4 Vacuum and Air Relief Valves

Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float.

2.1.4.5 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 wrench. One wrench shall be provided for valve operation.

2.1.5 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 boxes shall be of such length as will be adapted, without full extension, to the depth of cover required over the pipe at the valve location.

2.1.6 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: CAST-IN-PLACE CONCRETE.

2.1.7 Fire Hydrants

Fire hydrants shall conform to AWWA C503. 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 color directed. Hydrants shall be wet-barrel type conforming to AWWA C503, with either an automatic breakoff check valve or an auxiliary gate valve on hydrant branch.

2.1.8 Fire-Hydrant Hose Houses

Hose houses conforming to the requirements of NFPA 24 shall be furnished at each fire hydrant indicated on the drawings to have a fire-hydrant hose house. The following equipment, in addition to that listed in NFPA 24, paragraph 5-6.1, shall be furnished with each hose house:

200 feet of 2-1/2 inch, woven jacketed, rubber lined hose conforming to FS ZZ-H-451, Type III, Class B.

100 feet of 1-1/2 inch, woven jacketed, rubber lined hose conforming to FS ZZ-H-451, Type III, Class B.

One gated 2-1/2 by 1-1/2 by 1-1/2 inch wye.

The UL playpipes for 2-1/2 inch hose shall have 1-inch shutoff nozzle tip.

One playpipe for 1-1/2 inch hose with 1/2-inch shutoff nozzle or combination nozzle.

Two adapter fittings, 2-1/2 inch to 1-1/2 inch.

Two spanners for 1-1/2 inch hose.

2.1.9 Miscellaneous Items

2.1.9.1 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.

2.1.9.2 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.

2.1.9.3 Goosenecks

Copper tubing for gooseneck connections shall conform to the applicable requirements of ASTM B 88, Type K, annealed. Length of cable requirement connections be in accordance with standard practice.

2.1.9.4 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.

2.1.9.5 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.

2.1.9.6 Service Boxes

Service boxes shall be cast iron or concrete. Extension service boxes of the required length and having either screw or slide-type adjustment shall be installed at all service box locations. The boxes shall have housings of sufficient size to completely cover the service stop and shall be complete with identifying covers.

2.1.9.7 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

2.1.9.8 Meters

Meters shall be of the displacement type conforming to AWWA C700 or turbine type conforming to AWWA C701. Registers may be round or straight reading type. Connection to the water line shall be as required for the particular installation. All meters used for the same system shall be of one type and manufacturer.

2.1.9.9 Meter Boxes

Meter boxes shall be of cast iron or concrete of sufficient size to completely enclose the meter and shut-off valve or service stop. Box height shall extend from invert of the meter to final grade at the meter location. Cover shall be cast iron with the word "WATER" cast in it.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Asbestos-cement pipe shall be cut in accordance with AWWA M16. 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.

3.1.3 Joint Deflection

3.1.3.1 Asbestos-Cement Pipe

Maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, will be 5 degrees unless a lesser amount is recommended by the manufacturer.

3.1.3.2 Ductile-Iron Pipe

The maximum allowable deflection will be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Under no circumstances shall any of the water-line materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joining is completed. 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 Asbestos-Cement Pipe Installation

Asbestos-cement pipe shall be installed in accordance with AWWA C603, except as otherwise specified. Short lengths of pipe machined at each end or overall shall be used at fittings and rigid structures and for tying-in and closures.

3.1.4.2 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. Standard methods are available for making connections to various types of pipe, either under pressure or in the dewatered condition. Where made under pressure, these connections shall be installed as approved by the Contracting Officer.

3.1.4.3 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.

3.1.4.4 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 Asbestos-Cement Pipe

Couplings shall be installed in accordance with AWWA C603. Heavy couplings for service line connections, as hereinafter specified, shall be installed in accordance with the recommendations of the manufacturer.

3.1.5.2 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.

3.1.5.3 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.

3.1.5.4 Bonded Joints

Bonded joints shall be installed in accordance with details specified for joints under paragraph: MATERIALS.

3.1.5.5 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 extension service boxes of the lengths required. 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 equivalent to manufacturer's suggestions. Where two 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.

a. Connections to Asbestos-Cement Mains: Heavy asbestos-cement couplings may be utilized for connecting service lines smaller than 2 inches to new asbestos-cement water mains. Couplings shall have factory threaded outlets. Threads may be either iron-pipe thread or AWWA type. A corporation stop and a gooseneck shall be provided with the connection. Maximum sizes for outlets shall be as follows:

Pipe Size Inches	Outlet Sizes Inches
3 and 4	3/4, 1, 1-1/4
6 and larger	3/4, 1, 1-1/4, 1-1/2

(1) Service lines 1-1/2 inches and smaller shall have a service stop.

(2) Service lines 2 inches in size shall have a gate valve.

(3) 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. Three-inch and larger lines may use rubber-seated butterfly valves as specified above, or gate valves.

3.1.7 Setting of Fire Hydrants and Valves and Valve Boxes

3.1.7.1 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 and 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, and 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.

3.1.7.2 Valves and Valve Boxes

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 to a distance of 4 feet on all sides of the box, or the undisturbed trench face if less than 4 feet.

3.1.7.3 Valves and Hydrants

Valves and hydrants after delivery shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and the hydrant or valve shall be fully opened and fully closed to insure that all parts are in working condition.

3.1.7.4 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.

3.1.7.5 Valves

Check valves and Vacuum and air relief valves shall be installed in valve pits as shown.

3.1.8 Tapped Tees and Crosses

Tapped tees and crosses for future connections shall be installed where shown.

3.1.9 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 blocking, or metal tie rods and clamps or lugs, as directed. Valves shall be securely anchored or shall be provided with thrust blocking to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

3.1.9.1 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 shall be protected by galvanizing or by coating with bituminous paint.

3.1.9.2 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 150 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.

d. An unforeseeable cause which would result in excess cost.

The Contractor may request the 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: 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 200 psi pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

L = 0.00025ND(P raised to 1/2 power) for asbestos-cement pipe

L = 0.0001351ND(P raised to 1/2 power) for pipe materials other than asbestos-cement

In which L equals the allowable leakage in gallons per hour; N is the number of joints in the length of pipeline tested; D is the nominal diameter of the pipe in inches; and P is the average test pressure during the leakage test, in psi gauge. Should any test of pipe disclose leakage greater than that specified in the foregoing table, 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 reaction backing necessitates 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. Asbestos-cement 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

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed by AWWA C651.

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.

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SECTION 02730

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	(1990) Concrete Aggregate
ASTM C 94	(1990) Ready-Mixed Concrete
ASTM C 150	(1989) Portland Cement
ASTM C 260	(1986) Air-Entraining Admixtures for Concrete
ASTM C 425	(1991) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 428	(1985) Asbestos-Cement Nonpressure Sewer Pipe
ASTM C 541	(1991) Linings for Asbestos-Cement Pipe
ASTM C 700	(1991) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 828	(1990) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 924	(1989) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM D 1869	(1978; R 1989) Rubber Rings for Asbestos-Cement Pipe
ASTM F 402	(1988) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 49	(1975) 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

1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. Excavation and backfilling shall conform to SECTION: EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer.

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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-13, Certificates

Portland Cement; FIO.

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

PART 2 PRODUCTS

2.1 PIPE

Pipe may be of any of the following materials unless otherwise specified or indicated.

2.1.1 Clay Pipe and Fittings

ASTM C 700, Extra strength. Where indicated, pipe and fittings shall be acid resistant. Compression joints shall conform to ASTM C 425.

2.1.2 Asbestos-Cement Pipe and Fittings

ASTM C 428, ASTM C 541, ASTM D 1869. Fittings and specials for use with asbestos-cement pipes shall have strength not less than the pipe and conform to the maufacturer's requirements.

2.2 PORTLAND CEMENT

Portland Cement shall conform to ASTM C 150, Type V for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking. Air-entraining admixture conforming to ASTM C 260 shall be used with Type V cement. Where aggregates are alkali reactive, as determined in accordance with Appendix XI of ASTM C 33, a cement containing less than 0.60 percent alkalies shall be used.

2.3 PORTLAND CEMENT CONCRETE

Portland Cement Concrete shall conform to ASTM C 94, compressive strength of 4000 psi at 28 days, except for concrete thrust blocking, for cradle and encasement, or concrete blocks for manholes. Concrete used for thrust blocking and cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Adjacent Facilities

3.1.1.1 Water Lines

Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be closer horizontally than 10 feet to a water-supply main or service line, except that where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, the horizontal spacing may be a minimum of 6 feet. Where gravity-flow sewers cross above water lines, the sewer pipe for a distance of 10 feet on each side of the crossing shall be fully encased in concrete or shall be acceptable pressure pipe with no joint closer horizontally than 3 feet to the crossing. The thickness of the concrete encasement including that at the pipe joints shall be not less than 4 inches.

3.1.2 Pipe Laying

a. Pipe shall be protected during handling against impact shocks and free fall and the pipe interior shall be free of extraneous material.

b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.

c. Before making pipe joints all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted so as to obtain the degree of water tightness required.

d. Installations of solvent weld joint pipe, using ABS or PVC pipe and fittings shall be installed in accordance with ASTM F 402, and all required precautions shall be taken to assure adequate trench ventilation and protection for workers installing the pipe.

3.1.2.1 Caulked Joints

The packing material shall be well packed into the annular space so as to prevent the entrance of lead into the pipe. The remainder of the space shall be filled with molten lead that is hot enough to show a rapid change in color when stirred. Scum shall be removed before pouring. The lead shall be caulked to form a tight joint without overstraining the bell and shall have a minimum depth of 1 inch after caulking.

3.1.2.2 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

3.1.2.3 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

3.1.2.4 Width of Trench

If the maximum width of the trench at the top of the pipe, as specified in SECTION: EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, is exceeded for any reason other than by direction, the Contractor shall install at no additional cost to the Government such concrete cradling, pipe encasement, or other bedding as may be required to satisfactorily support the added load of the backfill.

3.1.2.5 Joints

Joints between different pipe materials shall be made as hereinbefore specified, using approved jointing materials.

3.1.2.6 Handling and Storage

Pipe, fittings and joint material shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities for plastic pipe, fittings, joint materials and solvents shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

3.1.3 Leakage Tests

Lines shall be tested for leakage by low pressure air testing, infiltration tests or exfiltration tests, as appropriate. Low pressure air testing for vitrified clay pipes shall be as prescribed in ASTM C 828. Low pressure air testing for concrete pipes shall be as prescribed in ASTM C 828. Low pressure air testing procedures for other

pipe materials shall use the pressures and testing times prescribed in ASTM C 828 and ASTM C 924, after consultation with the pipe manufacturer. Prior to infiltration or exfiltration tests the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permitted inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. When the Contracting Officer determines that infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed 0.2 gallons per inch diameter per 100 feet of pipeline per hour. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Government.

3.1.4 Test for Deflection

When flexible pipe is used, a deflection test shall be made on the entire length of the installed pipeline on completion of all work, including the leakage test, backfill, and placement of any fill, grading, paving, concrete, or superimposed loads. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. The ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 95 percent of the normal inside diameter of the pipe. A tolerance of plus 0.5 percent will be permitted. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface brinell hardness of not less than 150. It shall be center bored and through bolted with a 1/4-inch minimum diameter steel shaft having a yield strength of 70,000 psi or more, with eyes at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer such that a pull exerted on the opposite end of the shaft shall produce compression throughout the remote end of the ball, cylinder or circular section. Circular sections shall be so spaced that the distance from the external faces of the front and back sections shall equal or exceed the diameter of the circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through or by being flushed through with water, shall be cause for rejection of that run. When a deflection device is used for the test in lieu of the ball, cylinder, or circular sections described hereinbefore, such device shall be approved prior to use. The device shall be sensitive to 1.0 percent of the diameter of the pipe being measured and shall be accurate to 1.0 percent of the indicated dimension. Installed pipe showing deflections of 4.5 percent of the normal diameter of the pipe shall be retested by a run from the opposite direction. If the retest indicates a deflection in excess of the 4.5 percent, the suspect pipe shall be replaced. Any pipe showing deflections in excess of 5 percent at the end of one year following installation and acceptance will be replaced at no cost to the Government.

3.2 BUILDING CONNECTIONS

Building connections shall include the lines to and connection with the building waste drainage piping at a point approximately 5 feet outside the building, unless otherwise indicated. Where building drain piping is not installed, the Contractor shall terminate the building connections approximately 5 feet from the site of the building at a point and in a manner designated.

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SECTION 02811

UNDERGROUND IRRIGATION SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1990b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM B 43	(1991) Seamless Red Brass Pipe, Standard Sizes
ASTM D 1785	(1991) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2287	(1981; R 1988) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D 2464	(1991) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1990a) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(1991) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe Systems
ASTM D 2774	(1972; R 1983) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1990) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3261	(1990) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.2	(1983) Gages and Gaging for Unified Inch Screw Threads
ASME B16.15	(1985) Cast Bronze Threaded Fittings, Classes 125 and 250
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1013	(1988) Reduced Pressure Principle Backflow Preventers

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C901	(1988; Errata 1988) Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCHR)

FCCHR-01	(Jun 1988) 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

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	(1990) National Electrical Code

1.2 PERFORMANCE REQUIREMENTS

System shall operate with a minimum water pressure of 68 pounds per square inch (psi) at connection to meter and 35 psi at the last emitter in each circuit.

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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-01, Data

Design Analysis and Calculations; GA. Spare Parts; GA.

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.

1.3.2 SD-04, Drawings

Irrigation System; GA.

Detail drawings for valves, backflow preventers, automatic controllers, emitter heads. 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 emitters, zone valves, 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.

1.3.3 SD-06, Instructions

Irrigation System; GA.

Detailed procedures defining the Contractor's provisions for accident prevention, health protection, and other safety precautions for the work to be done.

1.3.4 SD-09, Reports

Field Tests; GA.

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.

1.3.5 SD-13, Certificates

Irrigation System; GA.

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.

1.3.6 SD-19, Operation and Maintenance Manuals

Irrigation 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 DELIVERY AND STORAGE

All equipment delivered and placed in storage 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.

1.5 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: Six emitters of each size and type, two valve keys for operating manual valves, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

2.2 PIPING MATERIALS

2.2.1 Red Brass Pipe and Associated Fittings

2.2.1.1 Pipe

Pipe shall conform to requirements of ASTM B 43, regular.

2.2.1.2 Fittings

Fittings shall be Class 250, cast bronze threaded conforming to the requirements of ASME B16.15.

2.2.2 Galvanized Steel Pipe and Associated Fittings

2.2.2.1 Pipe

Pipe shall conform to requirements of ASTM A 53, Schedule 40.

2.2.2.2 Fittings

Fittings shall be Class 150 conforming to requirements of ASME B16.3.

2.2.3 Polyvinyl Chloride (PVC) Pipe, Fittings and Solvent Cement

2.2.3.1 Pipe

Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40 or 80.

2.2.3.2 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.

2.2.3.3 Solvent Cement

Solvent cement shall conform to the requirements of ASTM D 2564.

2.2.4 Polyethylene (PE) Plastic Piping

2.2.4.1 Pipe

Pipe shall conform to AWWA C901, outside diameter base with dimension ratio (DR) of 9.3 to provide 150 psi minimum pressure rating.

2.2.4.2 Fittings

Fittings shall conform to ASTM D 3261, DR of 9.3.

2.2.5 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 80 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. Distribution tubing shall have a maximum outside diameter of 1/4 inch and a minimum wall thickness of 40 mils.

2.3 IRRIGATION AND EMITTER HEADS

2.3.1 Emitter Heads

Emitter heads shall be self-cleaning, pressure compensating diaphragm with one or six self-piercing barbed outlets; each capable of emitting 1 gallon 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 ends.

2.4.2 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.

2.4.3 Remote Control Valves, Electrical

Remote control valves shall be solenoid actuated globe valves of 1 inch size, suitable for 24 volts, 60/50 cycle, and designed to provide for shut-off in event of power failure. Valve shall be cast plastic housing suitable for service at 200 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.

2.4.4 Backflow Preventers

Reduced pressure principle assemblies, shall be tested, approved, and listed in accordance with FCCHR-01. Reduced pressure principle backflow preventers shall be in accordance with ASSE 1013.

2.4.4.1 Reduced Pressure Type Backflow Preventers

Backflow preventers shall be 150-pound threaded bronze mounted ball 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 shall be red brass pipe and fittings. Strainers shall be bronze construction with gasket caps. Units shall have 100-mesh stainless steel screen elements.

2.5 ACCESSORIES AND APPURTENANCES

2.5.1 Valve Boxes and Concrete Pads

2.5.1.1 Valve Boxes

Valve boxes shall be plastic lockable, for each gate valve, manual control valve, flush valve, quick coupler valve, air relief 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.

2.5.1.2 Concrete Pads

Concrete pads shall be precast or cast-in-place reinforced concrete construction for reduced pressure type backflow preventers and controller enclosure.

2.5.2 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 systems.

2.5.3 Emitter Head Accessories

2.5.3.1 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.

2.5.3.2 Pressure Regulator

Pressure regulator shall be provided at each drip system.

2.5.3.3 Tubing Stakes

Tubing stakes shall be plastic coated steel, or other non-corrosive strong material to secure tubing.

2.5.3.4 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.

2.5.3.5 Access Sleeve

Access sleeve shall be provided at buried flush valves placed in covered boxes. Lids of access sleeve shall be secured with removable lugs.

2.5.3.6 Flush Valves

Flush valves shall have brass components and installed as indicated.

2.5.4 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.

2.6 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 four 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 1 minute to 24 hours in one minute increments, set time within one percent; a switch allowing selected schedules to be repeated up to 3 times 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.

2.7 ELECTRICAL WORK

2.7.1 High Voltage

Electrical service to automatic controller shall be in accordance with Division 16 Sections. Provide final hookup to equipment as a part of the work of this Section.

2.7.2 Low Voltage

a. Connections between controller and remote control valves shall be made with direct burial AWG-UF, 600 volt wire, 14 gage or larger, insulation thickness 3/64-inch, utilizing low density high molecular weight polyethylene insulation.

b. Splices, where permitted, shall be waterproofed using connectors, or fusible heat shrink tubing.

c. Pilot wires shall be a different color or symbol for each controller station. Common wires shall be white with a different color stripe for each controller. Minimum size shall be No. 14 gage for control wires and 12 gage for common wires.

2.8 CONCRETE MATERIALS

Concrete shall have a compressive strength of 3500 psi at 28 days as specified in SECTION: 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: 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: 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. Minimum vertical clearances between lines shall be 1 inch.

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 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.

3.1.4 Valves

3.1.4.1 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.

3.1.5 Flush and Quick Coupling Valves

Flush and quick coupling 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 12 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

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.

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 remote control valve 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 200-foot intervals with 20-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 Backfill

3.1.10.1 Minimum Cover

Depth of cover shall be 18 inches for 1-1/4-inch pipe or smaller; 36 inches for pipes under traffic loads, farm operations, and freezing temperatures; and 18 inches for low-voltage wires. Remainder of trench or pipe cover shall be filled to within 3 inches of top with excavated soil, and compact soil with plate hand-held compactors to same density as undisturbed adjacent soil.

3.1.10.2 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: TREES, SHRUBS, GROUND COVERS AND VINES.

3.1.11 Adjustment

After grading, seeding, and rolling of planted areas, emitter heads outlets shall be adjusted above finished grade. Adjustments shall be made by providing new tubing of proper length.

3.1.12 Disinfection

Sprinkler system fed from a potable water system shall be disinfected upstream of backflow preventer in accordance with SECTION: WATER LINES.

3.1.13 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 backfilling 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: 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 by the Contracting Officer. 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 8 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals.

3.5 CLEANUP

Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed at the expense of the Contractor.

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SITE WORK

SECTION 02831

FENCE, CHAIN-LINK

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SECTION 02831

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	(1990) Ready-Mixed Concrete

FEDERAL SPECIFICATIONS (FS)

FS FF-P-101	(Rev F) Padlocks
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 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: SUBMITTAL DESCRIPTIONS.

1.2.1 SD-04, Drawings

Chain-Link Fence; GA.

Drawings showing post sizes and sections; post setting and bracing; gate details; details of attachment of fabric to support members; and any other details required to erect the fence along the lines indicated.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the following:

2.1.1 Chain Link Fence

FS RR-F-191/GEN.

2.1.1.1 Fabric

FS RR-F-191/1, Type I, zinc-coated steel wire with minimum coating weight of 1.2 ounces of zinc per square foot of coated surface, or Type II, aluminum-coated steel wire. Fabric shall be fabricated of 9-gauge wire woven in 2-inch mesh. Fabric height shall be 6 feet.

2.1.1.2 Gates

FS RR-F-191/2. Gates 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. Gate fabric shall be as specified for chain-link fabric. Vertical members of gate leaves shall be spaced so that no members are more than 8 feet apart. Gates over 10 feet wide shall be additionally braced with a 5/16-inch, minimum diameter, diagonal truss rod. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged for padlocking so that padlock will be accessible from both sides of the gate regardless of the latching arrangement.

2.1.1.3 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-section may be used for line posts in lieu of line post shapes specified for the other classes. Sizes shall be as specified in FS RR-F-191/3 for the class used. Line posts shall be of the same class throughout the fence. Terminal, corner, gate, and pull posts selected shall be of the same class throughout the fence. Gate post shall be either round or square, subject to the limitation specified in FS RR-F-191/3.

2.1.1.4 Braces

FS RR-F-191/3, zinc-coated; Class 1 Grade A or B, steel pipe, size SP1 Class 3, form steel sections, size FS1, conforming to FS RR-F-191/3, may be used as braces if Class 3 line posts are furnished.

2.1.1.5 Accessories

FS RR-F-191/4. Ferrous accessories shall be zinc- or aluminum-coated. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment.

2.1.2 Concrete

ASTM C 94, using 3/4-inch maximum-size aggregate, and having minimum compressive strength of 2000 psi at 28 days. Grout shall consist of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

2.1.3 Padlocks

FS FF-P-101, Type EPB, Size 1-3/4 inch. Padlocks shall be keyed alike and each lock shall be furnished with four keys.

PART 3 EXECUTION

3.1 GENERAL

Fence shall be installed to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line 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. Except where solid rock is encountered, posts shall be set in concrete to the depth of 36 inches. Where solid rock is encountered with no overburden, posts shall be set to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, posts shall be set to a minimum depth of 36 inches unless a penetration of 18 inches in solid rock is achieved before reaching the 36-inch depth in which case depth of penetration shall terminate. All portions of posts set in rock shall be grouted. Portions of posts not set in rock shall be set in concrete from the rock to ground level. Posts set in concrete shall be set in holes not less than 10 inches in diameter for terminal post and 8 inches in diameter for line posts. 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 so as to 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 type line posts may be mechanically driven provided soil conditions are such that the driven posts develop strengths at least equal to posts set in concrete and rock is not encountered. Driven posts shall be set to a minimum depth of 3 feet and shall be protected with drive caps when being set.

3.3 BRACES AND TRUSS RODS

Braces and truss rods shall be installed as required and in conformance with the standard practice for the fence furnished. Horizontal compression braces and diagonal truss tension rods shall be installed on fences over 6 feet in height. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal. No bracing is required on fences 6 feet high or less if a top rail is installed.

3.4 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.

3.5 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 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. The bottom of the installed fabric shall be 2 inches (plus or minus 1/2-inch) above the ground.

3.6 GATES

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated or Contracting Officer sees fit. Latches, stops, and keepers shall be installed as required. Gates shall be installed as recommended by the manufacturer. Padlocks shall be attached to gates or gate posts with chains to prevent padlock removal.

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SECTION 02936

WILD FLOWERS

PART 1 GENERAL

1.1 REFERENCES

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

AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01	(Amended thru: Aug 1988) Federal Seed Act Regulations (Part 201-202)

FEDERAL SPECIFICATIONS (FS)

FS JJJ-S-181	(Rev B) Seeds, Agricultural

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: SUBMITTAL DESCRIPTIONS.

1.2.1 SD-08, Statements

Delivery; FIO.

Delivery schedule, at least 10 days prior to the intended date of the first delivery.

Maintenance Report; FIO.

Written record of maintenance work performed.

Wildflower Establishment Period; FIO.

Written calendar time period for the wildflower establishment period.

1.2.2 SD-13, Certificates; GA.

Certificates of compliance certifying that materials meet the requirements specified, prior to the delivery of materials. Certified copies of the reports for the following materials shall be included:

a. Seed: For mixture, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, date tested and state certification.

1.3 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.3.1 Inspection

Seed shall be inspected upon arrival at the job site by the Contracting Officer for conformity to type and quality in accordance with paragraph: MATERIALS.

1.3.2 Storage

Materials shall be stored in areas designated by the Contracting Officer. Seed shall be stored in cool, dry locations away from contaminants.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Seed

2.1.1.1 Seed Classification

State-certified or state-approved seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS-01 and applicable state seed laws.

2.1.1.2 Seed Mixtures

Seed mixtures shall be proportioned by weight as follows

Wildflower Seed Mix

Botanical Name	Common Name	Mixture Percent by Weight	Percent Pure Live Seed
Baileya Multiradiata	Desert Marigold	20% (2 lbs)	95%
Neirembergia Violacea	Purple Cups	20% (2 lbs)	95%
Oenothera Speciosa	Evening Primrose	10% (1 lb)	95%
Penstemon Eatoni	Beardtongue	15% (1.5 lbs)	95%
Penstemon Parryi	Beardtongue	15% (1.5 lbs)	95%
Sphaeralcer Ambigua	Globe Mallow	20% (2 lbs)	95%
		100% (10 lbs)	

2.1.1.3 Quality

Seed shall conform to FS JJJ-S-181. Weed seed shall not exceed 1 percent by weight of the total mixture. Wet, moldy, or otherwise damaged seed shall be rejected.

2.1.1.4 Seed Mixing

The field mixing of seed shall be performed on site in the presence of the Contracting Officer.

2.1.2 Water

Water shall not contain elements toxic to plant life.

PART 3 EXECUTION

3.1 SEEDING

3.1.1 Seeding Time

Seed shall be sown from 3/1 to 6/1 for spring planting and from 11/1 to 12/3 for fall planting.

3.1.2 Wildflower Seeding Conditions

Wildflower seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the turf operations, proposed times shall be submitted to and approved by the Contracting Officer.

3.2 SITE PREPARATION

3.2.1 Finished Grading

3.2.1.1 Preparation

Wildflower areas shall be filled as needed or have surplus soil removed to attain the finished grade. Drainage patterns shall be maintained as indicated on drawings. Wildflower areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of erosion or grade deficiencies shall conform to topsoil requirements specified in SECTION: GRADING. Finished grade shall be 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas.

3.2.1.2 Protection

Finished graded areas shall be protected from damage by vehicular or pedestrian traffic and erosion.

3.3 SEEDING

3.3.1 General

Prior to seeding, any previously prepared seedbed areas compacted or damaged by interim rain, traffic or other cause, shall be reworked to restore the ground condition previously specified. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

3.3.2 Equipment Calibration

The equipment to be used and the methods of seeding shall be subject to the inspection and approval of the Contracting Officer prior to commencement of seeding operations. Immediately prior to the commencement of seeding operations, the Contractor shall conduct seeding equipment calibration tests in the presence of the Contracting Officer.

3.3.3 Applying Seed

3.3.3.1 Broadcast Seeding

Seed shall be uniformly broadcast at the rate of 10 pounds per acre using broadcast seeders. Half of seed shall be broadcast in one direction, and the remainder at right angles to the first direction. Seed shall be covered to an average depth of 1/4 inch by disk harrow, steel mat drag, cultipacker, or other approved device.

3.3.4 Water

Watering shall be started within 7 days after completing the seeded area. Water shall be applied at a rate sufficient to ensure moist soil conditions to a minimum depth of 1 inch. Run-off and puddling shall be prevented.

3.3.5 Clean Up

Excess and waste material shall be removed from the planting operation and shall be disposed of off the site. Adjacent paved areas shall be cleaned.

3.4 PROTECTION OF WILDFLOWER AREAS

Immediately after seeding, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed by the Contracting Officer.

3.5 WILDFLOWER ESTABLISHMENT PERIOD

3.5.1 Commencement

The Wildflower Establishment Period for establishing a healthy stand of wildflower shall begin on the first day of work under this contract and shall end three (3) months after the last day of seeding operations required by this contract. Written calendar time period shall be furnished to the Contracting Officer for the Wildflower Establishment Period.

3.5.2 Satisfactory Stand of Wildflowers

3.5.2.1 Seeded Area

A satisfactory stand of wildflowers from the seeding operation is defined as a minimum of 3 plants per square foot.

3.5.3 Maintenance During Establishment Period

3.5.3.1 General

Maintenance of the wildflowers areas shall include eradicating insects and diseases, protecting embankments and ditches from erosion, protecting wildflowers areas from traffic.

3.5.3.2 Repair

The Contractor shall re-establish as specified herein, eroded, damaged or barren areas. Mulch shall also be repaired or replaced as required.

3.5.3.3 Maintenance Report

A written record shall be furnished to the Contracting Officer of the maintenance work performed.

3.6 FINAL ACCEPTANCE

3.6.1 Preliminary Inspection

Prior to the completion of the Wildflowers Establishment Period, a preliminary inspection shall be held by the Contracting Officer. Time for the inspection shall be established in writing. The acceptability of the wildflowers in accordance with the Wildflowers Establishment Period shall be determined. An unacceptable stand of wildflowers shall be repaired as soon as seeding conditions permit.

3.6.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing.

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TREES, SHRUBS, GROUND COVERS, AND VINES

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF NURSERYMEN (AAN)

AAN-01	(1990) American Standard for Nursery Stock

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1909	(Basic) Fertilizer

1.2 SUBMITTALS

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

1.2.1 SD-07, Schedules

Application of Pesticide Material; GA.

A list of the proposed pesticide application equipment to be used in performance of the planting work, including descriptive data and calibration tests.

1.2.2 SD-08, Statements

Delivery; GA. Application of Pesticide Material; GA.

The following work plans, before work is started.

a. Delivery Schedule at least 10 days prior to the intended date of the first delivery.

b. Pesticide Treatment Plan, giving proposed sequence of pesticidetreatment work, before work is started. The pesticide trade name, chemical composition, formulation, concentration, application rate of active ingredients and methods of application for all materials furnished, and the name and state license number of the state certified applicator shall be included.

1.2.3 SD-09, Reports

Soil Test; GA. Percolation Test; GA.

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described. Soil test reports shall include recommendations for soil amendments and fertilizer and backfill mix.

1.2.4 SD-13, Certificates

Soil Amendments; GA. Plants; GA. Pesticide; GA.

Certificates of compliance certifying that materials meet the requirements specified, prior to the delivery of materials. Reports for the following materials shall be included.

a. Fertilizer: For chemical analysis and composition percent.

b. Agricultural Limestone: For sieve analysis and calcium carbonate equivalent.

c. Plant Materials: For botanical and common name, size, quantity by species, grade, nursery grown.

d. Pesticide Material: For EPA registration number and registered uses.

e. Soil Amendments: For compliance with requirements of this contract.

1.2.5 SD-18, Records

Plant Establishment Period; GA. Maintenance Report; GA. Maintenance Instructions; GA.

a. Maintenance Report. Written record of maintenance work performed and quantity of plant losses and replacements.

b. Plant Establishment Period. Written calendar time period for the beginning of the plant establishment period. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.

c. Maintenance Instruction. Written instructions for year-round care of installed plants.

1.3 SOURCE INSPECTIONS

1.3.1 Plant Materials

The Contractor shall notify the Contracting Officer in writing 24 hours before plant materials are delivered. Plant materials shall be subject to inspection at the growing site prior to delivery by the Contracting Officer. Any inspections shall be arranged and coordinated with the Contractor.

1.4 SHIPMENT, DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Shipment

1.4.1.1 Preparation

Preparation for shipment shall be done in a manner that will not cause shock or damage to branches, trunk, or root systems.

a. Container-Grown (C) Plants: Container size shall be provided as recommended by AAN-01. Plants shall be grown in a container sufficiently long for new fibrous roots to have developed and for root mass to retain its shape and hold together when removed from container. Container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

1.4.1.2 Antidesiccant Application

Plants shall be sprayed with an antidesiccant as leaf budding occurs or when plant material has soft growth.

1.4.2 Delivery

1.4.2.1 Identification

Plants shall be identified with durable waterproof labels and weather-resistant ink. Plants shall have attached labels stating the correct plant name and size.

1.4.2.2 Protection During Delivery

Plants shall be protected during delivery to prevent desiccation of the plant or damage to the roots or balls. Branches of plants shall be protected by tying-in the branches and covering all exposed branches.

1.4.2.3 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.2.4 Pesticide

Pesticide materials shall be delivered to the site in the original unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration numbers and the registered uses.

1.4.3 Inspection

Plant material shall be inspected upon arrival at the jobsite by the Contracting Officer for conformity to the paragraph: PLANTS and paragraph: Shipment, and any unacceptable plant material shall be removed from the jobsite.

1.4.4 Storage

1.4.4.1 Plant Storage

Plants not installed on the day of arrival at the site shall be stored and protected in areas designated by the Contracting Officer. Plants shall be protected from exposure to wind and shall be shaded from the sun. Covering that will allow air to circulate and prevent internal heat from building up shall be provided. Bare-root plants shall be heeled-in. All plants shall be kept in a moist condition by watering with a fine mist spray until planted.

1.4.4.2 Storage of Other Materials

Soil amendments shall be stored in dry locations away from contaminants. Pesticide materials shall not be stored with other landscape materials. Storage of materials shall be in areas designated or as approved by the Contracting Officer.

1.4.5 Handling

Care shall be taken to avoid injury to plants. Materials shall not be dropped from vehicles. Container grown plants shall be handled by the container. Plants shall not be handled by the trunk or stems.

1.4.5.1 Time Limitation

a. Mulch: Limitation of time between installing plant and placing mulch is 48 hours.

b. Trunk Wrap: Limitation of time between installing deciduous trees and wrapping the trunks is 24 hours.

1.5 WARRANTY

Furnished plants shall be guaranteed to be in a vigorous growing condition for a period of 12 months regardless of the contract time period. A plant shall be replaced one time under this guarantee. Transplanted existing plants require no guarantee. A written calendar time period for the guarantee of plant growth shall be furnished to the Contracting Officer.

PART 2 PRODUCTS

2.1 PLANTS

2.1.1 Varieties

Plants shall be nursery grown or plantation grown stock conforming to AAN-01 and shall be of the varieties specified in the plant list bearing botanical names listed in one or more of the publications listed under "Nomenclature" in AAN-01.

2.1.2 Substitutions

Substitutions will not be permitted without written request from the Contractor for approval by the Contracting Officer.

2.1.3 Growing Conditions

Plants shall be grown under climatic conditions similar to those in the locality of the project.

2.1.4 Quality

Well shaped, well grown, vigorous, healthy plants having healthy and well branched root systems shall be provided. Plants shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plants shall be provided that are typical of the species or variety and conforming to standards as set forth in AAN-01 and as specified herein.

2.1.5 Shade and Flowering Trees

A height relationship to caliper shall be provided as recommended by AAN-01. Height of branching should bear a relationship to the size and variety of tree specified and with the crown in good balance with the trunk. Trees shall not be "poled" or the leader removed.

a. Single stem: Trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there should be no division of the trunk which branches more than six inches from ground level.

c. Specimen: A plant shall be provided that is well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

2.1.5.1 Deciduous Shrub

Plants shall be provided that have the height and number of primary stems as recommended by AAN-01. An acceptable plant shall be well shaped with sufficient well-spaced side branches recognized by the trade as typical for the variety grown in the region.

2.1.5.2 Broadleaf Evergreen

Plants shall be provided that have ratio of height-to-spread as recommended by AAN-01. An acceptable plant shall be well shaped and recognized by the trade as typical for the variety grown in the region.

2.1.5.3 Groundcovers and Vines

Plants shall be provided with the minimum number of runners and length of runner as recommended by AAN-01. Plants shall be furnished that have heavy, well developed and balanced top with vigorous well developed root system and shall be furnished in containers.

2.1.6 Size

Plants shall be furnished in sizes indicated. Plants larger in size than specified may be provided at no additional cost to the Government.

2.1.7 Measurement

Plant measurements shall be in accordance with AAN-01.

2.2 TOPSOIL

Topsoil shall be the existing surface soil stripped to the depth indicated and stockpiled on the site in accordance with SECTION: GRADING.

2.2.1 Soil Test

A soil test shall be performed for pH, particle size, chemical analysis and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of plants specified.

2.3 SOIL AMENDMENTS

Soil amendments consist of lime, fertilizer, bonemeal, organic soil amendments and soil conditioner.

2.3.1 Lime

Lime shall be agricultural limestone and shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 90 percent will pass a 10-mesh sieve and at least 50 percent will pass a 60-mesh sieve.

2.3.2 Fertilizer

Fertilizer shall be commercial grade, free flowing, uniform in composition and conforming to CID A-A-1909.

2.3.2.1 Dry Fertilizer

a. Granular fertilizer: Consists of nitrogen-phosphorous-potassium ratio: 12 percent nitrogen 12 percent phosphorous, and 12 percent potassium.

b. Controlled-Release Fertilizer: Consists of nitrogen-phosphorous-potassium ratio: 20 percent nitrogen 10 percent phosphorous, and 5 percent potassium. Controlled-release fertilizer may be in packet or tablet form.

2.3.2.2 Liquid Fertilizer

Commercially available liquid fertilizer shall consist of completely soluble plant foods suitable for application as foliage spray.

2.3.3 Bonemeal

Bonemeal shall be a finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.3.4 Organic Soil Amendments

2.3.4.1 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, or other wood waste material free of stones, sticks, and toxic substances harmful to plants and stabilized with nitrogen and having the following properties:

Particle size	Minimum percent by weight passing
No. 4 mesh screen	95
No. 8 mesh screen	80

Nitrogen Content	Minimum percent based on dry weight
Redwood Sawdust	0.5
Fir Sawdust	0.7
Fir or Pine Bark	1.0

2.3.5 Soil Conditioner

For single use or in combination to meet requirements for topsoil.

2.3.5.1 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum of 95 percent calcium sulfate by volume.

2.3.5.2 Aluminum Sulfate

Aluminum sulfate shall be commercial grade.

2.4 MULCH

Mulch shall be free from weeds, mold and other deleterious materials.

2.4.1 Inert Mulch Material

Inert mulch materials shall be riverbank stone, crusher run rock, volcanic rock, and shall range in size from 1/2 inch to 3/4 inch.

2.4.2 Organic Mulch Material

Organic mulch materials shall be ground or shredded bark ranging in size from 1/2 inch to 1 inch.

2.5 TRUNK WRAPPING MATERIAL

Tree wrap shall be two thicknesses of crinkled paper cemented together with a layer of bituminous material. Wrapping material shall be a minimum of 4 inches in width and have a stretch factor of 33-1/3 percent. Twine for tying shall be lightly tarred medium or coarse sisal yarn.

2.6 GUYING AND STAKING MATERIAL

2.6.1 Stakes

Stakes for tree support shall be rough sawn wood, free from knots, rot, cross grain, or other defects that would impair the strength. Standard stakes shall be hardwood or fir treated with pentachlorophenol.

2.6.1.1 Bracing Stakes

Bracing stakes shall be a minimum of 2 inches by 2 inches or 2-1/2 inches in diameter by 8 feet long and pointed at one end.

2.6.1.2 Ground Stakes

Ground stakes shall be a minimum of 2 inches by 2 inches or 2-1/2 inches in diameter by 3 feet long and pointed at one end.

2.6.2 Guying Material

2.6.2.1 Guying Wire

Guying wire shall be 12-gauge annealed galvanized steel wire.

2.6.2.2 Guying Cable

Guying cable shall be a minimum of five-strand, 3/16-inch diameter cadmium plated steel cable.

2.6.3 Chafing Guard

Hose chafing guards shall be new or used 2-ply reinforced rubber or plastic hose and shall be all the same color on the project. Length shall be 1-1/2 times the circumference of the plant at its base.

2.6.4 Flags

Flags to be fastened to guys shall be white surveyor's plastic tape, 6 inches in length.

2.6.5 Turnbuckles

Turnbuckles shall be galvanized or cadmium-plated steel and have a 3-inch minimum lengthwise opening fitted with screw eyes.

2.7 WATER

Water shall not contain elements toxic to plant life.

2.8 ANTIDESICCANT

Antidesiccant shall be an emulsion that will provide a film over plant surfaces permeable enough to permit transpiration, and shall not damage the plant.

2.9 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide, and miticide. Pesticide material shall be labeled for use and applied only as registered by EPA and approved herbicide, insecticide, fungicide, nematocide, rodenticide or miticide.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Verify Grades

The Contractor shall demonstrate to the Contracting Officer that verify the finished grades are as indicated on drawings, and the placing of topsoil and smooth grading has been completed in accordance with SECTION: GRADING.

3.1.2 Underground Obstructions to Planting

The location of underground utilities and facilities shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.2 SITE PREPARATION

3.2.1 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted by the Contracting Officer to meet field conditions.

3.2.2 Protection of Existing Vegetation

Existing trees, shrubbery, and beds that are to be preserved shall be barricaded in a manner that will effectively protect them during planting operations.

3.3 EXCAVATION

3.3.1 Obstructions Below Ground or Poor Drainage

When obstructions below ground or poor drainage affect the contract operation, proposed adjustments to plant location, type of plant and planting method or drainage correction shall be submitted to and approved by the Contracting Officer.

3.3.2 Plant Pits

Plant pits shall be dug to produce vertical sides and flat, uncompacted bottoms. When pits are dug with an auger and the sides of the pits become glazed, the glazed surface shall be scarified. The size of plant pits shall be as shown.

3.4 PERCOLATION TEST

Test for percolation shall be done to determine positive drainage of plant pits and beds. The Contracting Officer shall be notified in writing of all soil and drainage conditions detrimental to growth of plant material and shall submit proposal for correcting the condition.

3.5 PLANTING CONDITIONS

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted to and approved by the Contracting Officer.

3.6 INSTALLATION

3.6.1 Backfill Soil Mixture

The backfill soil mixture shall be a proportioned mixture thoroughly mixed by volume of topsoil and selected soil amendments as recommended by this soils report.

3.6.2 Setting Plants

Plants shall be set plumb and held in position until sufficient soil has been firmly placed around roots or ball. Plants shall be set in relation to surrounding grade so that they are even with the depth at which they were grown in the nursery, or container.

3.6.3 Controlled-Release Fertilizer

Controlled-release fertilizer shall be placed in packet or tablet form in the plant pit in the immediate vicinity of the feeding roots in accordance with the manufacturer's recommendations.

3.6.4 Container-Grown Plants

Non-biodegradable containers or platforms shall be removed without damage to the plant or root system. Biodegradable containers shall be split. Planting pits shall be

backfilled with backfill mix, tamped and watered. Form a 4-inch high earth saucer around individual plants.

3.6.5 Staking and Guying

3.6.5.1 One Bracing Stake

Trees 4 to 6 feet tall shall be held in place with one bracing stake. The tree shall be held firmly to the stake with a double strand of wire. A chafing guard shall be used where the wire contacts the tree. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or roots.

3.6.5.2 Two Bracing Stakes

Trees over 6 feet tall shall be held in place with two bracing stakes placed on opposite sides. The tree shall be held firmly between the stakes with a double strand of wire. Chafing guards shall be used where the wire contacts the tree. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or roots.

3.6.5.3 Three Guying Wires

Trees shall be held firmly in place with three guying lines of double strand wire spaced equidistantly around the tree. The line shall be anchored with ground stakes. The line shall be anchored to the tree at a point equal to one half its height. Chafing guards shall be used where the line contacts the tree. One turnbuckle shall be centered on each line for tree straightening purposes. Ground stakes shall be driven into firm ground outside the earth saucer and plant pit with the top of the stake flush with the ground surface.

3.6.6 Pruning

The total amount of foliage shall be pruned by one-fourth to one-third on installed trees and shrubs to compensate for loss of roots and transplanting shock. The typical growth habit of individual plants shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth shall not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off."

3.6.7 Mulch

Mulch shall be spread to a uniform thickness of 2 inches within 48 hours after planting. Mulch shall be kept out of the crowns of shrubs and off buildings, sidewalks and other facilities.

3.6.8 Trunk Wrap

The trunks to deciduous trees shall be wrapped within 24 hours after planting. Trees 1-1/2 inches or greater in caliper shall be wrapped with the specified material beginning at the base and extending up to the first branches. The wrapping shall be securely tied with twine at the top and bottom and at 18-inch intervals.

3.6.9 Water

Plants shall be watered as necessary to maintain an adequate supply of moisture within the root zone. Run-off, puddling and wilting shall be prevented.

3.6.10 Antidesiccant Application

Plants requiring further protection shall be sprayed with anti-desiccant in accordance with manufacturer's recommendations.

3.7 MAINTENANCE DURING PLANTING OPERATION

Installed plants shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed and shall continue until the plant establishment period commences. The maintenance includes watering, pruning, wound dressing, straightening and other necessary operations. Plant beds and earth saucers shall be kept free of weeds, grass and other undesired vegetation. Plants shall be checked for settlement and shall be reset to the proper grade as necessary. Run-off, puddling and wilting shall be prevented. The Contractor shall perform all necessary maintenance during the installation period.

3.8 CARE OF EXISTING PLANT MATERIAL

3.8.1 Identification

Existing plant material to be treated shall be tagged on the site and/or as indicated.

3.8.2 Pruning and Cavity Work

An arborist shall perform the required pruning and cavity work on existing plants. Dead wood larger than 1/2 inch in diameter, branches interfering with or hindering the healthy growth of plants, and diseased branches shall be removed. Cut back or remove branches as necessary to give the plants proper shape and balance. Stubs, improper cuts, and broken limbs shall be removed. Clean cuts shall be made flush with the parent trunk. Wounds larger than 1/2 inch in diameter and scars from contractor operations shall be cleaned. Cavities shall be shaped to provide drainage and decayed wood shall be removed. Exposed cambium layers shall be sealed with shellac.

3.9 APPLICATION OF PESTICIDE MATERIAL

When pesticide becomes necessary to remove a disease or pest, a state-certified applicator shall apply required pesticide in accordance with State EPA label restrictions and recommendations. Hydraulic equipment shall be provided for the liquid application of pesticides with a leak-proof tank, positive agitation methods, controlled application pressure and metering gauges. A pesticide treatment plan shall be provided to the Contracting Officer as specified in paragraph: SUBMITTALS.

3.10 RESTORATION AND CLEAN UP

3.10.1 Restoration

Pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.10.2 Clean Up

Excess and waste material from the planting operation shall be removed and disposed of off the site. Adjacent paved areas shall be cleared.

3.11 PLANT ESTABLISHMENT PERIOD

3.11.1 Commencement

On completion of the last day of the planting operation, the Contractor shall verify that all plants have been installed in accordance with contract requirements, and the plant establishment period for maintaining installed plants in a healthy growing condition shall commence and shall be in effect for 12 months. When the planting operation extends over more than one season or there is a variance to the planting times, plant establishment periods shall be established for the work completed, as directed. A written calendar time period shall be furnished to the Contracting Officer for the beginning of the plant establishment period. When there is more than one plant establishment period, describe the boundaries of the planted area covered for each period.

3.11.2 Maintenance During Establishment Period

3.11.2.1 General

Maintenance of plants shall include straightening plants, tightening and replacing stakes and guying material, repairing tree wrapping, protecting plant areas from erosion, supplementing mulch, accomplishing wound dressing, removing dead or broken tip growth by pruning, checking for girdling of plants and maintaining plant labels, watering, weeding, applying fertilizer and pesticides removing and replacing unhealthy plants.

3.11.2.2 Water

The plants shall be watered as necessary to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of one inch of absorbed water per week delivered in the form of natural rain or augmented as required by periodic waterings. Run-off, puddling and wilting shall be prevented. Contractor shall be responsible for all costs for water associated with the irrigation system during the construction period.

3.11.2.3 Weeding

Grass and weeds in earth saucers and plant beds shall not be allowed to reach a height of 3 inches before being completely removed, including the root growth.

3.11.2.4 Unhealthy Plants

A plant shall be considered unhealthy or dead when the main leader has died back, or 25 percent of the crown is dead. Determine the cause for an unhealthy plant. Unhealthy or dead plants shall be removed immediately and shall be replaced within 7 calendar days at the Contractor's expense.

3.11.2.5 Fertilizing

The plants shall be topdressed at least once during the period of establishment with dry fertilizer at the rate of 1 pound per 100 square feet of plant pit or bed area or foliar feed plants with liquid fertilizer. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

3.11.2.6 Settlement

Topsoil shall be added to maintain grade and to maintain earth saucers. Serious settlement affecting the setting of the plant in relation to the depth at which it was grown requires replanting in accordance with paragraph: INSTALLATION.

3.11.2.7 Pesticide Treatment

Treatment for diseases or pest shall be in accordance with paragraph: APPLICATION OF PESTICIDE MATERIAL.

3.11.2.8 Maintenance Report

A written record shall be furnished to the Contracting Officer of the maintenance work performed, the quality of plant losses, cause for plant loss and replacements made on each site visit.

3.11.2.9 Maintenance Instruction

Written instructions shall be furnished to the Contracting Officer for year-round care of installed plants.

3.11.3 Replacement Plants

Plants shall be provided for replacement in accordance with paragraph: PLANTS. Replacement plants shall be installed in accordance with paragraph: INSTALLATION. No extended plant establishment period shall be required for replacement plants. A plant will be replaced in accordance with paragraph: WARRANTY.

3.12 FINAL ACCEPTANCE

3.12.1 Preliminary Inspection

The Contracting Officer shall conduct a preliminary inspection 120 days prior to the completion of the plant establishment period. Time for the inspection shall be established in writing. The quantity and type of plants installed and the acceptability of the plants in accordance with the plant establishment period shall be determined.

3.12.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing. Acceptance of the planting operation is subject to the guarantee of plant growth.

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SECTION 02951

ROCK COLOR TREATMENT

PART 1 GENERAL

1.1 SUBMITTALS

All submittals are FIO in this section.

1.1.1 SD-01, Data

Manufacturer's literature discussing physical characteristics, application and installation instructions for desert varnish treatment.

1.1.2 SD-07, Schedules

A list of the proposed application equipment to be used.

1.1.3 SD-14, Sample

Submit minimum 12 inch x 12 inch desert varnish sample on typical rock from the site. Rock to be treated shall be rock which has a surface which has been newly exposed to light and weather as a result of the construction process.

1.2 WARRANTY

Desert varnish treatment material shall be warranted to withstand durability experiments for 100 years on rock or the equivalent of 4000 wet-dry cycles of scrubbing under running water with no visible signs of degradation.

PART 2 PRODUCTS

2.1 DESERT VARNISH MATERIAL

Desert varnish material shall be an aqueous solution of salts of iron (FE) and manganese (MN) and other trace elements including copper (CU) and zinc (ZN). The material shall contain no caustic or alkaline chemicals and shall be manufactured as a concentrate that can be diluted with up to 6 parts water to achieve desired color intensity.

PART 3 EXECUTION

3.1 APPLY DESERT VARNISH

Apply desert varnish to all surfaces of on-site rocks that have been newly exposed to light and weather as a result of the construction process, as well as any rocks that, at the discretion of the Contracting Officer, display insufficient weathering.

3.1.1 Application

Apply desert varnish at strength necessary to achieve, desired coloration (match sample previously submitted and accepted). Apply at temperatures above 40°F with low-pressure, non-corrosive spay equipment. Filter as necessary and avoid running or pudding. Rinse equipment thoroughly.

3.1.2 Thickness

Coating thickness shall be between 20 and 100 micrometers.

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SECTION 03301

CAST-IN-PLACE 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.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 211.1	(1989) Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 301	(1989) Structural Concrete for Buildings
ACI 305R	(1989) Hot Weather Concreting
ACI 315	(1980; Rev 1986) Details and Detailing of Concrete Reinforcement
ACI 318	(1989; 318R-89) Building Code Requirements for Reinforced Concrete
ACI 347R	(1988) Guide to Formwork for Concrete

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1982; R 1988) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1991) Structural Steel
ASTM A 53	(1990b) Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 82	(1990a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 184	(1990) Fabricated Deformed Steel Bar Mats for Concrete Reinforcment
ASTM A 185	(1990a) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM A 497	(1990b) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 499	(1989) Steel Bars and Shapes, Carbon Rolled from "T" Rails
ASTM A 615	(1990) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 675	(1990a) Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706	(1990) Low-Alloy Steel Deformed Bars for Concrete Reinforcment
ASTM C 31	(1990) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1990) Concrete Aggregates
ASTM C 39	(1986) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42	(1990) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 94	(1990) Ready-Mixed Concrete
ASTM C 143	(1990a) Slump of Hydraulic Cement Concrete
ASTM C 150	(1989) Portland Cement
ASTM C 171	(1991) Sheet Materials for Curing Concrete
ASTM C 172	(1990) Sampling Freshly Mixed Concrete
ASTM C 192	(1990a) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1991) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1986) Air-Entrainment Admixtures for Concrete
ASTM C 309	(1989) Liquid Membrane Forming Compounds for Curing Concrete
ASTM C 494	(1990) Chemical Admixtures for Concrete

ASTM C 597	(1983) Pulse Velocity through Concrete
ASTM C 618	(1991) Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete
ASTM C 803	(1990) Penetration Resistant of Hardened Concrete
ASTM C 805	(1985) Rebound Member of Hardened Concrete
ASTM C 1064	(1986) Test Method for Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1987) Practice for Laboratories Testing Concrete and Concrete Aggregate for use in Construction and Criteria for Laboratory Evaluations
ASTM C 1107	(1991) Packaged Dry Hydraulic-Cement Grout (non-shrinkable)
ASTM D 75	(1987) Sampling Aggregates
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Strutural Construction
ASTM D 1752	(1984) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 2628	(1991) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM E 96	(1992) Water Vapor Transmission of Materials

AMERICAN WELDING SOCIETY (AWS)

AWS D1.4	(1979) Structural Welding Code - Reinforcing Steel

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI DA4	(1990) Manual of Standard Practice

CORPS OF ENGINEERS (COE)

COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete

FEDERAL SPECIFICATIONS (FS)

FS TT-S-00227	(Rev E; Am 3) Sealing Compound, Elastomeric Type, Single Component for Calking, Sealing, and Glazing (for Buildings and Other Structures)

1.2 SUBMITTALS

1.2.1 Concrete Mixture Proportions

Concrete mixture proportions shall be determined by the Contractor, in accordance with the requirements in paragraph: MIXTURE PROPORTIONING, and submitted for approval at least 14 days prior to commencing concrete placing operations. The proportions of all ingredients and nominal maximum coarse aggregate size that will be used in the manufacture of each quality of concrete shall be stated. Proportions shall indicate the weight of cement, pozzolan and water; the weights of aggregates in a saturated surface-dry condition; and the quantities of admixtures. The submission shall be accompanied by test reports from a laboratory complying with ASTM C 1077 which show that proportions thus selected will produce concrete of the qualities indicated. No substitution shall be made in the source or type of materials used in the work without additional tests to show that the new materials and quality of concrete are satisfactory.

1.2.2 Sampling and Testing

Certified copies of laboratory test reports, including all test data for aggregate, admixtures, and curing compound shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturer of the materials and submitted for approval. Copies of all test reports shall be submitted to the Contracting Officer within 24 hours of completion of the test. The individual who samples and tests concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of concrete Field Testing Technicians, Grade I.

1.2.3 Cement and Pozzolan

Cement and pozzolan shall be delivered and used directly from a mill of a producer designated as a prequalified source. A list of prequalified cement sources is available from the Commander and Director, U.S. Army Engineer Waterways Experiment Station, P.O. Box 631, Vicksburg, MS 39181-0631. Cement and pozzolan will be accepted on the basis of the manufacturer's certification of compliance, accompanied by mill test reports that materials meet the requirements of the specification under which they are furnished. Certification and mill test reports shall identify the particular lot furnished. No cement or pozzolan shall be used until notice of acceptance has been given by the Contracting Officer. Cement and pozzolan will be subject to check testing from samples obtained at the mill, at transfer points, or at the project site, as scheduled by the Contracting Officer, and such sampling will be by or under the supervision of the Government at its expense. Materials not meeting the specifications shall be promptly removed from the site of work.

1.2.4 Nonshrink Grout

1.2.4.1 General

Descriptive literature of the grout proposed for use shall be furnished together with a certificate from the manufacturer stating that it is suitable for the application or exposure for which it is being considered. In addition, a detailed plan shall be submitted for approval, showing equipment and procedures proposed for use in mixing and placing the grout.

1.2.4.2 Prepackaged Material

Prepackaged material requiring only the addition of water shall be accepted on the basis of certified laboratory test results showing that the material meets the requirements of ASTM C 1107. When fine aggregate is to be added, the Contractor shall also furnish for approval the design mix proportions together with certified copies of laboratory test results indicating that the mix is in conformance with the requirements of ASTM C 1107.

1.2.4.3 Volume-Change Controlling Ingredient

Mixture proportions using a volume-change controlling ingredient shall be submitted for approval. The submittal shall include the design mix proportions of all ingredients and certified copies of laboratory test results indicating that the materials and the mix is in conformance with the requirements of ASTM C 1107.

1.2.5 Formwork Design

Formwork design shall conform to ACI 301 and ACI 347R. Formwork for special effects shall be approved by the Contracting Officer. Design analysis and calculations for form design and methodology used in the design shall be submitted to the Contracting Officer for approval.

1.2.5.1 Detail Drawings

Detail drawings showing details conforming to ACI 315 and ACI 318 shall be submitted to the Contracting Officer for approval prior to being incorporated into the work. Detail drawings shall show location, building elevations, formwork fabrication details, reinforcements, embedments, dimensions, concrete strength, interface with adjacent materials, and special placing instructions, in sufficient detail to cover fabrication, placement, stripping and finishing. Manufacturer's data including literature describing the form materials, accessories, and form releasing agents; including the rate of application of form releasing agents shall be submitted to the Contracting Officer for approval.

1.2.5.2 Concrete Reinforcing System

Detail drawings showing reinforcing steel schedules, size, grades, and splicing and bending details shall be submitted to the Contracting Officer for approval. Drawings shall show support details including types, sizes and spacing.

1.2.5.2.1 Welder Certification

The Contractor shall submit a list of names of qualified welders for approval by the Contracting Officer.

1.2.5.2.2 Reinforcing Steel

Certified copies of mill reports attesting that the reinforcing steel furnished meets the requirements specified, prior to the installation of reinforcing steel shall be submitted to the Contracting Officer for approval.

1.3 GENERAL REQUIREMENTS

1.3.1 Strength Requirements

Concrete for all work shall have a 28-day compressive strength f'c of 3,000 pounds per square inch. Concrete made with high-early strength cement shall have a 7-day compressive strength f'c of 3,000 pounds per square inch.

1.3.2 Water-Cement Ratio

The maximum water-cement ratio shall be 0.45 for all concrete structures.

1.3.3 Air Content

Air Content as determined by ASTM C 231 shall not exceed 7 percent in all concrete. During the preparation of mix designs the Contractor shall determine the amount of air to be used in the concrete mixtures and this amount will be reported in the mix design submittal. Once production of concrete has commenced the amount of air shall not vary more than 1-1/2 percent from the selected air content, nor shall it ever exceed the value stated above.

1.3.4 Slump

The slump shall be determined in accordance with ASTM C 143 and shall be within the range of 1 to 4 inches. Where placement by pump is approved, the slump shall not exceed 6 inches and shall remain within a 3-inch band.

1.4 MIXTURE PROPORTIONING

Trial design batches and testing requirements shall be the responsibility of the Contractor. Samples of approved aggregates shall be obtained in accordance with the requirements of ASTM D 75. Samples of materials other than aggregate shall be representative of those proposed for the project and shall be accompanied by the manufacturer's test reports indicating compliance with applicable specified requirements. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on the methodology described in ACI 211.1. Trial mixtures shall be designed for maximum permitted slump and air content. The temperature of concrete in each trial batch shall be reported. For each maximum aggregate size selected at 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 will be plotted showing the relationship between water-cement ratio and strength.

1.4.1 Average Strength

In meeting the strength requirements specified in paragraph: STRENGTH REQUIREMENTS, the selected mixture proportion shall produce an average strength (fcr) exceeding the specified strength f'c by the amount indicated below with a water-cement ratio at or below that specified in paragraph: WATER-CEMENT RATIO. Where a concrete production facility has test records, a standard deviation shall be established. Test records from which a standard deviation is calculated shall represent materials, including admixtures, quality control procedures and conditions similar to those expected in the current construction. Changes in materials and proportions within the test records shall not have been more restricted than those for the proposed work and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders (or beams) made from the same sample of concrete and tested at 28 days.

1.4.2 Required Average Compressive Strength

Required average compressive strength fcr 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:

$fcr = f'c + 1.34S$ where S = standard deviation
$fcr = f'c + 2.33S - 500$

1.4.3 Modification Factor For 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 may be established as the product of the calculated standard deviation and a modification factor from the following table:

No. of tests (1)	Modification factor for standard deviation
less than 15	(See 2)
15	1.16
20	1.08
25	1.03
30 or more	1.00

(1) Interpolate for intermediate numbers of tests.

(2) When a concrete production facility does not have field strength test records for calculation of standard deviation or the number of tests is less than 15, the required average strength shall be the specified strength plus 1200 for specified strengths of 3000 to 5000 psi.

1.5 MATERIALS STORAGE

Cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants. 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. 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. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

1.6 JOINT FILLER AND SEALANT

Certificates of compliance stating that the joint filler and sealant materials conform to the requirements specified shall be submitted to the Contracting Office for approval.

1.7 FORMWORK DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified herein. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

1.8 WELDER QUALIFICATION

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Welding procedures qualified by others and welders qualified by another employer may be accepted as permitted by AWS D1.4.

1.9 CONCRETE DELIVERY TICKETS

Copes of certified delivery tickets for all concrete used in the construction shall be provided to the Contracting Officer.

1.10 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.10.1 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 produced unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

PART 2 PRODUCTS

2.1 ADMIXTURES

Admixtures to be used, when required or permitted, shall conform to the appropriate specification listed below:

2.1.1 Accelerating Admixture

Accelerating Admixtures shall comply with the requirements of ASTM C 494, Type C except no calcium chloride will be allowed.

2.1.2 Air-Entraining Admixture

Air-entraining Admixture shall conform with the requirements of ASTM C 260.

2.1.3 Water-Reducing or Retarding Admixtures

Water-reducing or retarding admixtures shall conform to the requirements of ASTM C 494, Type A, B or D.

2.2 CEMENTITIOUS MATERIALS

Cementitious Materials shall be Portland cement or Portland cement in combination with pozzolan and shall conform to appropriate specifications listed below.

2.2.1 Portland Cement

Portland cement shall meet the requirements of ASTM C 150, Type II including false set requirements and low alkali.

2.2.2 High-Early-Strength Portland Cement

High-Early-Strength Portland cement shall comply with the requirements of ASTM C 150, Type III with tricalcium aluminate limited to 8 percent, low alkali, used only when specifically approved in writing.

2.2.3 Pozzolan

Pozzolan shall comply with the requirements of ASTM C 618, Class F, with loss on ignition limited to 6 percent.

2.3 AGGREGATES

Coarse aggregate shall be ASTM C 33 size No. 57.

2.4 CURING MATERIALS

2.4.1 Impervious Sheet Materials

Impervious Sheet Materials shall conform to ASTM C 171, type optional except polyethylene film, if used, shall be white opaque.

2.4.2 Membrane-Forming Curing Compounds

Curing Compounds shall conform to ASTM C 309, Type 1-D or 2. If the Contractor proposes to use a sodium silicate solution, 60 days must be allowed for compliance testing by a Corps laboratory. Certification letters will not be considered adequate or acceptable evidence of compliance.

2.5 EMBEDDED ITEMS, PLATES, ANGLES, AND ANCHORS

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: ACOUSTICAL CEILINGS. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel. Plates, angles, anchors and embedments shall conform to ASTM A 36 and shall be prime painted with inorganic zinc primer.

2.6 NONSHRINK GROUT

Nonshrink grout shall conform to the requirements of ASTM C 1107.

2.7 FLOOR HARDENER

Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These silicofluoride can be used individually or in combination. Proprietary hardeners may be used if approved by the contracting officer.

2.8 VAPOR BARRIER

The 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.

2.9 WATER

Water for mixing and curing shall be fresh, clean, drinkable, and free of injurious amounts of oil, acid, salt, and alkali, except that undrinkable water may be used if it meets the requirements of CRD-C 400.

2.10 REINFORCING STEEL

Reinforcing steel shall be galvanized if clearance to an exterior face is 1 inch or less. Reinforcing steel shall be deformed bars conforming to ASTM A 615 or ASTM A 706, grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82.

2.11 FORM RELEASE AGENTS

Form release agents shall be manufacturer's standard, nonstaining, nonpetroleum based, compatible with surface hardener finish coating.

2.12 SURFACE SEALER

Surface sealer shall be methyl methacrylate polymer acrylic emulsion, clear color.

2.13 CONTRACTION-JOINT STRIPS

Contraction-joint strips shall be 1/8 inch thick tempered hardboard conforming to AHA A 135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

2.14 EXPANSION-JOINT FILLER

Expansion-joint filler shall be premolded material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 3/8-inch thick and of a width applicable for the joint formed.

2.15 JOINT SEALANT

Joint Sealant shall conform to the following:

2.15.1 Preformed Polychloroprene Elastomeric Joint Seals

Preformed polychloroprene elastomeric joint seals shall meet the requirements of ASTM D 2628.

2.15.2 Field Molded Sealants

Field molded sealants shall conform to FS TT-S-00227, Type II for vertical joints and Type I for horizontal joints, Class A. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material shall be compressible, nonshrink, nonreactive with sealant, and nonabsorptive material type such as extruded butyl or polychloroprene foam rubber.

2.16 FORM TIES

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 1/4 inch nor more than 1 inch deep and not more than 1 inch in diameter. Removable tie rods shall be not more than 1-1/2 inches in diameter.

2.17 DOWELS

Dowels shall conform to ASTM A 675, Grade 80, or ASTM A 499. Steel pipe conforming to ASTM A 53, Schedule 80 may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

2.18 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184.

2.19 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185 or ASTM A 497.

2.20 WIRE TIES

Wire ties shall be 16-gauge or heavier black annealed steel wire.

2.21 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI DA4 and shall be steel or precast concrete blocks. Precast concrete blocks shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finished surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

2.22 FORM WORK FOR PAVEMENTS AND STEPS

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 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.

2.22.1 Pavement Forms

Pavement forms shall be of a height equal to the full depth of the finished pavement.

2.22.2 Step Forms

Step outside forms shall have a height equal to the full depth of the step.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACES

Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Conduit and other similar items shall be in place and clean of any deleterious substance. Subgrades shall be constructed to the specified grade and cross section prior to concrete placement. Subgrades shall be placed and compacted to conform with applicable requirements of SECTION: EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.1.1 Foundations

Earthwork shall be as specified in SECTION: EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS. Flowing water shall be diverted without washing over freshly deposited concrete. Rock foundations shall be cleaned by high velocity air-water jets, sandblasting, or other approved methods. Debris and loose, semi-detached or unsound fragments shall be removed. Rock surfaces shall be moist but without free water when concrete is placed. Semiporous subgrades for foundations and footings shall be damp when concrete is placed. Pervious subgrades shall be sealed by covering with an impervious membrane. Soil is to be clean and free of excess dirt or foreign substances. Additionally, the foundation shall be inspected by the Contractor prior to concrete placement in order to certify that it is ready to receive concrete. The results of each inspection shall be submitted in writing.

3.1.1.1 Pavement Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the pavement and supported between side forms.

3.1.1.2 Step Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the steps. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

3.1.2 Vapor Barrier

Unless otherwise indicated, subgrades for slabs in buildings shall be covered with a vapor barrier. Vapor barrier edges shall be lapped at least 4 inches and ends shall be lapped not less than 6 inches. Patches and lapped joints shall be sealed with pressure-sensitive adhesive or tape not less than 2 inches wide and compatible with the membrane.

3.1.3 Formwork Installation

Formwork shall be erected in accordance with the detail drawings to ensure that the finishing concrete members conform accurately to the indicated dimensions, lines, elevations, and finishes. Deflection shall not exceed 1/360th of each component span or distance between adjacent supports. Deflections and tolerance shall not be cumulative. Form lines shall be installed as necessary to provide the required finish. Forms shall be coated with form release agents before reinforcement is placed.

3.1.3.1 Form Setting

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the specified surface requirements in Table 1 of this Section. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface as to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the

quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concrete and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

3.1.3.2 Chamfering

Except as otherwise shown, external corners that will be exposed shall be square in the forms.

3.1.3.3 Coating

Forms for Class C finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probably freezing temperatures coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.1.4 Form Setting for Pavement and Step

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 clean 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, oil is mandatory.

3.1.4.1 Form Setting for Pavement

Forms for pavements shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10-feet long section. After forms are set, grade and alignment shall be checked with a 10-feet straightedge. Forms shall have a transverse slope of 1/8 inch per foot. Side forms shall not be removed for 12 hours after finishing has been completed.

3.1.4.2 Form Setting for Steps

The forms of the front of the steps shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms for the back of steps shall remain in place until the face and top of the step have been finished as specified for concrete finishing.

3.2 REINFORCEMENT GENERAL

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety.

3.2.1 Placement of Reinforcement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318 at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

3.2.2 Splicing

Splices of reinforcement shall conform to ACI 318 and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6-inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.2.3 Welded-Wire Fabric

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

3.2.4 Dowels

Dowels shall be installed in slabs on grade at locations indicated and at right angels to joint being dowelled. Dowels shall be accurately aligned parallel to the finished concrete surface and rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

3.3 INSTALLATION OF EMBEDDED ITEMS

Embedded items shall be free from oil, loose scale or rust, and paint. Before placing 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. 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.

3.4 BATCHING, MIXING AND TRANSPORTING CONCRETE

3.4.1 Ready-Mixed Concrete

Ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C 94. The manufacturer of the concrete shall furnish with each batch of concrete before unloading at the site, a delivery ticket on which is printed, stamped or written the information required in ASTM C 94, including all the items listed under additional information for certification.

3.4.2 Admixtures

Admixtures shall be batched within an accuracy of 3 percent. Concrete that shows evidence of total collapse or segregation caused by the use of an admixture shall be removed from the site.

3.4.3 Addition of Water after Batching

No water from the truck system or elsewhere shall be added after the initial introduction of mixing water for the batch except when on arrival at the jobsite, the slump of the concrete is less than that specified and the addition of water does not exceed the maximum water-cement ratio.

3.5 SAMPLING AND TESTING FREQUENCIES

Sampling and Testing is the responsibility of the Contractor and shall be performed by an approved testing agency.

3.5.1 Aggregates

Aggregates shall be sampled and tested in accordance with ASTM C 33. One gradation shall be performed each shift in which concrete is being delivered.

3.5.2 Sampling of Concrete

Samples of concrete for air, slump, temperature and strength shall be taken in accordance with ASTM C 172.

3.5.2.1 Air Content

Air content shall be sampled and tested in accordance with ASTM C 231. One test shall be performed in conjunction with each strength test performed.

3.5.2.2 Slump

Slump shall be sampled and tested in accordance with ASTM C 143. One test shall be performed in conjunction with each strength test performed.

3.5.2.3 Temperature

Temperature shall be sampled and tested in accordance with ASTM C 1064. One test shall be performed in conjunction with each strength test performed and when, in the opinion of the Contracting Officer, there may be a problem.

3.5.3 Evaluation and Acceptance of Concrete

3.5.3.1 Samples for strength testing

Samples of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 150 cubic yards of concrete, nor less than once for each 5000 square feet of surface area for slabs or walls. If this sampling frequency results in less than 5 strength tests for a given class of concrete, tests shall be made from at least 5 randomly selected trucks or from each truck if fewer than 5 truck loads are used. 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 practicable, in the same manner as that given to the portion of the structure the samples represent.

3.5.3.2 Cylinder Testing

Cylinder for acceptance testing shall be molded and cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days.

3.5.3.3 Compressive Strength Evaluation

Evaluation of 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 required strength by more than 500 psi.

3.5.4 Investigation of Low-Strength Test Results

When any strength test of standard-cured test cylinder 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 load-carrying capacity of the structure is not jeopardized. Nondestructive testing in accordance with ASTM C 597, ASTM C 803 or ASTM C 805 may be permitted by the Contracting Officer to determine the relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. When strength of concrete in place is considered potentially deficient, the Contracting Officer may require that cores 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 shall be determined by the Contracting Officer to least impair the strength of the structure. The cores shall be air dried in temperatures between 60-80 degrees F, relative humidity less than 60% for seven days before testing and shall be tested dry. Concrete in the area represented by the core testing will be considered adequate if

the average strength of the cores is equal to or at least 85% of the specified strength requirement and if no single core is less than 75% of the specified strength requirement. 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. Concrete work evaluated by structural analysis or by results of a load test and found deficient shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed under the supervision of and approved by the Contracting Officer at the expense of the Contractor.

3.6 CONVEYING CONCRETE

Concrete shall be conveyed from mixer to forms as rapidly as possible and within the time interval specified in paragraph: CONCRETE PLACEMENT by methods which will prevent segregation or loss of ingredients.

3.6.1 Chutes

When concrete can be placed directly from a truck mixer or other transporting equipment, chutes attached to this equipment may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes an other similar equipment will not be permitted for conveying concrete except when specifically approved.

3.6.2 Buckets

When buckets are used the design shall be such that concrete of the required slump can be readily discharged. Bucket gates shall be essentially grout tight when closed. The bucket shall provide means for positive regulations of the amount and rate of deposit of concrete in each dumping position.

3.6.3 Belt Conveyors

Belt conveyors may be used when approved. Belt conveyors shall be designed for conveying concrete and shall be operated to assure a uniform flow of concrete to the final place of deposit without segregation or loss of mortar. Conveyors shall be provided with positive means for preventing segregation of the concrete at transfer points and the point of placement.

3.6.4 Pumping

Concrete may be conveyed by positive displacement pumps when approved. The pump shall be the piston or squeeze pressure type. The pipeline shall be rigid steel pipe or heavy duty flexible hose. The inside diameter of the pipe shall be at least three times the maximum size of the coarse aggregate. Distance to be pumped shall not exceed the limits recommended by the pump manufacturer. Concrete shall be supplied to the pump continuously. When pumping is completed, the concrete remaining in the pipeline shall be ejected without contaminating the concrete in place. After each use, the equipment shall be thoroughly cleaned. Flushing water shall be wasted outside the forms.

3.7 CONCRETE PLACEMENT

Concrete shall be placed within thirty minutes after discharge into nonagitating equipment. When concrete is truck mixed or when a truck mixer or agitator is used for transporting concrete mixed by a concrete plant mixer the time or revolution limitations as stated in ASTM C 94 shall be met. Concrete not delivered directly to the forms shall be placed within 15 minutes after it has been discharged from the truck.

3.7.1 Placing Operation

Concrete placement will not be permitted when, in the opinion of the Contracting Officer, weather conditions prevent proper placement and consolidation. Concrete shall be deposited as close as practical to its final position in the forms, and in so depositing 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 place in a single layer; and all concrete shall be placed with a minimum of lateral movement. Sufficient placing capacity shall be provided so that /concrete placement can be kept plastic and free of cold joints while concrete is being placed.

3.7.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrating equipment, except for slabs 4 inches or less. Vibrators shall not be used to transport concrete within the forms. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator and a standby power source shall be available at all times during concrete placement. The vibrators shall have a frequency of not less than 8000 vibrations per minute, and the head diameter and amplitude shall be appropriate for 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 few inches. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. The vibrator shall be held stationary until the concrete is consolidated and then withdrawn slowly. The use of form vibrators must be specifically approved. Slabs 4 inches and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique.

3.7.3 Cold Weather Requirements

Concrete shall not be placed without special protection measures, approved by the Contracting Officer, 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.

3.7.4 Warm Weather Requirements

The temperature of the concrete placed during warm weather shall not exceed 85 degrees F. Cooling of the mixing water and/or aggregates may be necessary to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 90 degrees F.

3.8 CONSTRUCTION JOINTS

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, the location and type of construction joint shall be approved by 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.

3.8.1 Joint Sealing

Joint sealing shall be as specified in SECTION: CAULKING AND SEALANTS.

3.8.2 Cleaning

No sooner than 72 hours after joints are sealed, faces and other exposed surfaces of cast-in-place concrete shall be washed down, cleaned with soap and water applied with a soft bristle brush, then washed down again with clean water, or by other approved procedures. Discolorations which cannot be removed by these procedures, shall be considered defective work. Cleaning work shall be done when temperature and humidity conditions are such that surfaces dry rapidly. Care shall be taken during cleaning operations to protect adjacent surfaces from damage.

3.8.3 Sawed Joints

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

3.8.4 Expansion Joints

Premolded expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 1/8-inch radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed-and-oiled wood strip temporarily secured to the top thereof to form a recess 3/4-inch deep to be filled with sealant. The wood strip shall be removed after the concrete has set. In lieu of the wood strip a removable expansion filler cap designed and fabricated for this purpose may be used.

3.8.4.1 Expansion Joints for Pavements and Steps

Expansion joints shall be formed with 3/8 inch joint filler strips. Joint filler shall be placed with the top edge 1/4 inches 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. Concrete at the joint shall be surface dry and the atmospheric and pavement temperatures shall be above 50 degrees F at the time of application of joint-sealing materials. Joints shall be filled with sealer flush with the concrete surface in such manner as to minimize spilling on the walk surface. Spilled sealing material shall be removed immediately and the surface of the walk cleaner.

3.8.5 Joint Sealant in Sawed Joints

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

3.9 FINISHING CONCRETE

Concrete finishes shall conform to the approved finishes. Finishing shall be accomplished at the time of concrete placement or immediately after formwork removal.

3.9.1 Formed Surfaces

3.9.1.1 Repair of Surface Defects

Holes left after the removal of form ties shall be cleaned and filled with patching mortar. Holes left by the removal of tie rods shall be reamed and filled by dry-packing. The temperature of concrete, mortar patching material, and ambient air shall be above 50 degrees F while making repairs and during the curing period. Concrete with defects which affect the strength of the member or with excessive honeycombs will be rejected, or the defects shall be corrected as directed by the Contracting Officer.

3.9.1.2 Class C Finish

Concrete surfaces shall be relatively smooth with a texture imparted by the forms used; all fins and loose material shall be removed.

3.9.2 Unformed Surfaces

In cold weather, the air temperature in areas where concrete is being finished shall not be less than 50 degrees F. In hot windy weather when the rate of evaporation of surface moisture as determined by ACI 305R, may reasonably be expected to exceed 0.2 pounds per square foot per hour; coverings, windbreaks, or fog sprays may be necessary as determined by the Contracting Officer to prevent premature setting and

drying of the surface. The dusting of surfaces with dry materials or the addition of water during finishing will not be permitted, except where indicated. Finished surfaces shall be plane, with no deviation greater than 3/16 inch when tested with a 10-foot straightedge. Exterior surfaces shall be pitched to drain.

3.9.2.1 Rough-Slab Finish

Slabs to receive fill or mortar setting beds shall be screeded with straightedges immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible.

3.9.2.2 Float Finish

Slabs where indicated shall be given a float finish, all others shall receive a steel trowel finish as described below. Screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. After the concrete has stiffened to permit the operation and the water sheen has disappeared, it shall be wood floated.

3.9.2.3 Trowel Finish

Slabs where indicated shall be given a trowel finish immediately following floating. Surfaces shall be trowelled to produce smooth, dense slabs 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.

3.9.2.4 Broom Finish

After floating and lightly trowelling, a broom finish shall be applied to the traffic surface of all slabs where indicated on the drawings. The trowelled surface shall be broomed with a fiber-bristle brush in a direction transverse to that of the main traffic.

3.9.2.5 Washed Aggregate

After wood floating, slabs where indicated, shall be given a washed aggregate finish. Just before the concrete hardens, wash the surface with water and scrub if necessary with a stiff bristle brush to expose the aggregate.

3.9.2.6 Floor Hardener

Floor hardener shall be applied after the concrete has been air dried for 14 days, except in areas to be carpeted or which have ceramic tile. Three coats shall be applied, each the day after the preceding coat was applied. For the first application, one pound of the silicoflouride shall be dissolved in one gallon of water. For subsequent applications, the solution shall be two pounds of silicofluoride to each gallon of water. The 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 manufactuer's instructions. During application, the area should be well ventilated and precautions taken when applying silicofluorides due to the toxicity of the salts. Any compound that contacts glass or aluminum shall be immediately removed with clear water.

3.9.2.7 Surface Sealing

After cleaning, exterior exposed architectural concrete surfaces indicated shall be given one coat of surface sealer, spray applied unless otherwise approved. Adjacent surfaces shall be protected to prevent damage from the surface sealer.

3.9.2.8 Sandblasting

After curing, surfaces indicated shall receive a light sandblast. Sandblasting shall remove the smooth texture of the concrete but shall not expose aggregate or pit the surface.

3.10 CURING AND PROTECTION

3.10.1 General

All concrete shall be cured by an approved method for a period of 7 days (3 days for Type III cement). Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, flowing water and mechanical injury. All materials and equipment needed for adequate curing and protection shall be available at the placement site prior to the start of concrete placement. No vehicular traffic will be allowed on slabs for a period of 7 days or until the concrete has reached the specified design strength. No fire or excessive heat shall be permitted near or in direct contact with the concrete at any time. Curing shall be accomplished by any of the following methods, or combinations thereof, as approved by the Contracting Officer.

3.10.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned. When wooden forms are left in place during curing, they shall be kept wet at all times. If the formes are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Horizontal surfaces shall be cured by ponding, by covering with a 2-inch minimum thickness of continuously saturated sand, or by covering with impervious sheet materials as specified in paragraph: IMPERVIOUS SHEET MATERIALS.

3.10.3 Membrane Curing

Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. Surfaces shall be thoroughly moistened with water and the 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 compound shall be applied in a one-coat continuous operation by mechanical spraying equipment, at a uniform coverage in accordance with the manufactuer's printed instructions. Concrete surfaces which have been subjected

to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. On surfaces permanently exposed to view, the surface shall be shaded from direct rays of the sun for the duration of the curing period. 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.

3.11 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 1/2 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.

3.11.1 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.

3.11.2 Nonshrink Grout

Nonshrink grout shall be mixed and placed in accordance with material manufactuer's written recommendations. Forms of wood or other suitable materials shall be used to retain the grout. The grout shall be placed quickly and continuously, completely filling the space without segregation or bleeding of the mix.

3.11.3 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back one inch and immediately covered with a parge coat of mortar consisting of one 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 be left untreated. Curing shall comply with paragraph: CURING AND PROTECTION.

3.12 REMOVAL OF FORMS

Forms shall be removed in a manner that will prevent injury to the concrete and ensure the complete safety of the structure.

TABLE 1. TOLERANCES FOR FORMED SURFACES

1. Variation from the plumb:	
a. In the lines and surfaces of columns, piers, walls, and in arises	In any 10 feet of length ----- 1/4 inch Maximum for entire length ---- 1 inch
b. For exposed corner columns, control-joint grooves, and other conspicuous lines	In any 20 feet of length ----- 1/4 inch Maximum for entire length ---- 1/2 inch
2. Variation from the level or from the grades indicated on the drawings:	In any 10 feet of length ----- 1/4 inch In any bay or in any 20 feet of length ---------- 3/8 inch Maximum for entire length ---- 3/4 inch
a. In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores	
b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	In any bay or in any 20 feet of length ---------- 1/4 inch Maximum for entire legnth ---- 1/2 inch
3. Variation of the linear building lines from established position in plan	In any 20 feet ---------- 1/2 inch Maximum ---------- 1 inch
4. Variation of distance between walls, columns, partitions	1/4 inch per 10 feet of distance but not more than 1/2 inch in any one bay, and not more than 1 inch total variation
5. Variation in the sizes and locations of sleeves, floor openings, and wall opening	Minus ---------- 1/4 inch Plus ---------- 1/2 inch
6. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls	Minus ---------- 1/4 inch Plus ---------- 1/2 inch
7. Footings:	
a. Variation of dimensions in plan	Minus ---------- 1/2 inch Plus ---------- 2 inches when formed or plus 3 inches when placed against unformed excavation
b. Misplacement	2 percent of the footing width in the direction of misplacement but not more than ---------- 2 inches
c. Reduction in thickness	Minus ---------- 5 percent of specified thickness
8. Variation in steps:	
a. In a flight of stains	Riser ---------- 1/8 inch Tread ---------- 1/16 inch
b. In consecutive steps	Riser ---------- 1/16 inch Tread ---------- 1/8 inch

3.13 BACKFILLING PAVEMENTS AND STEPS

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.

3.14 THICKNESS EVALUATION

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section.

3.14.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 0.25 inches the deficient section will be removed, between regularly scheduled joints, and replaced.

3.15 DEFECTIVE WORK

Defective work shall be replaced as directed by the Contracting Officer, using approved procedures at the Contractor's expense.

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SECTION 03450

PRECAST ARCHITECTURAL 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.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 211.1	(1989) Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 315	(1980; Rev 1986) ACI Detailing Manual: Section Details and Detailing of Concrete Reinforcement
ACI 318	(1989; 318R-89) Building Code Requirements for Reinforced Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 494	(1990) Chemical Admixtures for Concrete
ASTM C 1017	(1990) Chemical Admixtures for Use in Producing Flowing Concrete

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1990) Structured Welding Code - Steel

PRECAST PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI Mnl-116	(1985; 3rd Ed) Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products
PCI Mnl-117	(1977) Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products
PCI Mnl-122	(1989; 2nd Ed) Architectural Precast Concrete

1.2 GENERAL REQUIREMENTS

Precast concrete units shall be designed and fabricated by an experienced and acceptable precast concrete manufacturer. The manufacturer shall have been regularly and continuously engaged in the manufacture of precast concrete work similar to that indicated on the drawings for at least 3 years. Precast work shall be coordinated with the work of other trades. Precast concrete shall meet all requirements of SECTION: CAST-IN-PLACE CONCRETE, except as modified herein.

1.3 DESIGN

1.3.1 Standards and Loads

Precast unit design shall conform to ACI 318 and PCI Mnl-122. Design loads for precast concrete shall be as indicated on the drawings. A differential temperature of 60 degrees F, between interior and exterior faces of the units, shall be considered in the design. Stresses due to restrained volume change caused by shrinkage and temperature differential, handling, transportation and erection shall be accounted for in the design.

1.3.2 Connections

Connection of units to other members, or to other units shall be of the type and configuration indicated. The design and sizing of connections for all design loads shall be by the Contractor.

1.3.3 Concrete Strength

Precast concrete units shall have a 28-day compressive strength of 5000 psi.

1.3.4 Concrete Proportion

Selection of proportions for concrete shall be based on the methodology presented in ACI 211.1. The concrete proportion shall be developed using the same type and brand of cement, the same type and gradation of aggregates, and the same type and brand of admixture that will be used in the manufacture of precast concrete units for the project. Calcium chloride shall not be used in precast concrete and admixtures containing chloride ions, nitrates, or other substances that are corrosive shall not be used in prestressed concrete.

1.3.5 Calculations

Calculations for design of members and connections not shown shall be made by a professional engineer experienced in the design of precast architectural concrete. Calculation shall include the analysis of member for lifting stresses and the sizing of the lifting inserts.

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: SUBMITTAL DESCRIPTIONS.

1.4.1 SD-01, Data

Calculations; GA.

Design calculations, prior to the manufacture of any precast architectural concrete units for the project.

Mix Design; GA.

A statement giving the maximum nominal coarse aggregate size, the proportions of all ingredients and the type and amount of any admixtures that will be used in the manufacture of each strength and type of concrete, prior to commencing operations. The statement shall be accompanied by test results from an approved testing laboratory, certifying that the proportions selected will produce concrete of the properties required. No substitutions shall be made without additional tests to verify that the concrete properties are satisfactory.

1.4.2 SD-04, Drawings

Architectural Concrete System; GA.

Detail drawings showing details in accordance with ACI 315 and ACI 318, including installation details. Detail drawings shall indicate separate identification marks for each different precast unit, location of units in the work, elevations, fabrication details, welding details, reinforcement, connections, dimensions, interface with adjacent members, blocking points for units stored at the precast concrete plant or at the jobsite, lifting points and special handling instructions in sufficient detail to cover manufacture, handling, and erection.

1.4.3 SD-09, Reports

Materials; GA

Certified copies of test reports including all test data and all test results. Tests for compressive strength of concrete shall be performed by an approved independent commercial testing laboratory.

1.4.4 SD-14, Samples

Copper Slag Aggregate; GA.

Three cubic feet of mixed crushed natural copper slag aggregate as is to be used for the surfaces of all exterior exposed precast concrete panel faces shall be provided for approval. The sample shall be of all aggregate size variations (1/2 inch to 1-1/2 inch) and of representative color variations (black to purple to red-brown). Along with the sample information shall be provided as the aggregates inertness, hardness and soundness. Upon approval of the aggregate sample enough aggregate shall be provided to fabrication the sample precase concrete walls as defined below.

Precast Concrete Wall; GA.

Three 4'-0" x 4'-0" x 10 inch samples of precast unit finish required for the project. Samples shall show matrix color, surface color, surface texture and panel back finish. The samples shall be maintained at the job site untit approval by the Contracting Officer for removal or incoporating in the project. The mock-up shall be used to establish quality and acceptance of precast units to be used on the project and shall show the exterior finish (matrix color, surface color, surface texture and aggregate) panel back finish, edge treatment, joint treatment, reinforcement, anchorage insert, lifting inserts and other accessories.

Manufacturer's Qualifications; GA.

A statement giving the qualifications of the precast concrete manufacturer and of the installers, prior to commencing operations.

Inspection at the Site

Immediately prior to placement all precast concrete units shall be inspected for quality to insure all precast units conform to the requirements specified. Inspection for quality will include but not necessarily be limited to the following elements; color, texture, dimensional tolerances, chipping, cracking, staining, warping and honeycombing. All defective precast concrete units shall be replaced or repaired as approved.

PART 2 PRODUCTS

2.1 MATERIALS

Except as otherwise specified, material shall conform to SECTION: CAST-IN-PLACE CONCRETE.

2.1.1 Aggregates

Aggregates for all exterior exposed architectural surfaces shall be natural crushed copper slag. The slag shall be cleaned of silt and organic impurities. It shall be a maximum size of 1-1/2 inch to a minimum of 1/2 inch with 80 percent of the aggregate used being larger than 1 inch. Evidence of the aggregate inertness, soundness and hardness shall be provided as information under SD-14, Samples - Copper Slag Aggregate of this section.

2.1.2 Reinforcing Steel

Reinforcing steel shall be galvanized if clearance to an exterior face is 1 inch or less.

2.1.3 Tie Wire

Tie wire shall be soft monel or 18-8 stainless steel.

2.1.4 Inserts

Inserts shall be manufacturer's standard, suited for the application.

2.1.5 Plates, Angles, Anchors and Embedments

Material shall be as specified in PCI Mnl-117. Steel items, other than stainless, shall be coated with a rust-inhibiting paint or shall be hot-dip galvanized. Steel items, including items embedded in concrete, shall be either stainless steel or hot dip galvanized steel.

2.1.6 Form Release Agent

Release agent shall be manufacturer's standard nonstaining type.

2.1.7 Admixtures

Admixtures shall conform to ASTM C 494. Plasticizing admixture, if used, shall conform to ASTM C 1017.

2.2 PRECAST CONCRETE UNITS

Precast concrete units shall be manufactured and cured in accordance with the applicable provisions of PCI Mnl-116 and PCI Mnl-117. Units shall be manufactured within the allowable tolerances given in PCI Mnl-116, PCI Mnl-117 and PCI Mnl-122.

2.2.1 Formwork

Forms shall be steel or lumber of adequate thickness, braced, stiffened, anchored and aligned to produce precast architectural concrete units within required dimensional tolerances. Forms shall be sufficiently rigid to provide dimensional stability during handling and concrete placement and consolidation. Fiberglass-reinforced plastic, plastic coated wood, elastomeric or other nonabsorptive material shall be used for making tight joints and rustication pieces.

2.2.2 Reinforcement

Fabrication and placement of reinforcement shall conform to the details shown on the approved detail drawings and PCI Mnl-116 and PCI Mnl-117.

2.2.3 Embedded Accessories

Anchors, inserts, lifting devices, and other accessories which are to be embedded in the precast units shall be furnished and installed in accordance with the approved detail drawings. Embedded items shall be accurately positioned in their designed location, and shall have sufficient anchorage and embedment to satisfy design requirements.

2.2.4 Stripping

Precast concrete units shall not be removed from forms until units develop sufficient strength to safely strip the formwork and to remove the precast concrete units from the forms to prevent damage to the units from overstress or chipping.

2.2.5 Identification

Each precast concrete unit shall be marked to correspond to the identification marks for each different precast unit shown on the detail drawings.

2.2.6 Finishes

2.2.6.1 Exterior Exposed Surfaces

All major exterior building precast concrete surfacess exposed to view shall be finished with an exposed uniform surface of "copper slag" aggregate. All edge faces of panels and edge faces of openings in panels will be smooth and lightly sandblasted. The aggregate is to be evenly placed in the bottom of the panel casting forms to a depth of approximately 3 inches. The aggregate will be adhered to the face of the panel by the natural flow of the concrete during placement of vibration in the panel forms. The finished aggregate surface will be lightly sandblasted to remove surface cement residue left on the aggregate after the panels are placed.

2.2.6.2 Exterior Exposed Surfaces and Exposed Panel Edge Faces

All interior building precast concrete surfaces and panel edge faces shall be smooth with a brush sandblasted finish. Remove sheen from the concrete surface with no reveal of aggregate.

2.2.6.2 Other Surfaces

Surfaces of precast units not exposed to view or not otherwise indicated to be finished shall be finished in accordance with SECTION: CAST-IN-PLACE CONCRETE.

PART 3 EXECUTION

3.1 ERECTION

Precast units shall be erected in accordance with the detail drawings and without damage to other units or to adjacent members. Units shall be set true to alignment and level, with joints properly spaced and aligned both vertically and horizontally. Erection tolerances shall be in accordance with the requirements of PCI Mnl-117 and PCI Mnl-122. As units are being erected, shims and wedges shall be placed as required to maintain correct alignment. After final attachment, precast units shall be grouted as shown. After erection, welds and abraded surfaces of steel shall be cleaned and touched-up with a zinc-rich paint. Welds shall be made by a certified welder in accordance with the manufacturer's erection drawings. Pickup points, boxouts, inserts, and the like shall be finished to match adjacent areas after erection. Erection of precast units shall be supervised and performed by workmen skilled in this type of work. Welding and the qualifica ions of welders shall be in accordance with AWS D1.1.

3.2 JOINT SEALING

Joint sealing shall be as specified in SECTION: CALKING AND SEALANTS.

3.3 CLEANING

Not sooner than 72 hours after joints are sealed, faces and other exposed surfaces of precast concrete discolored during erection shall be cleaned to remove dirt and stains by dry scrubbing with a stiff fiber brush, wetting the surface and vigorous scrubbing of the finish with a stiff fiber brush followed by additional washing, or by chemical cleaning compounds such as detergents or other commercial cleaners. Commercial cleaners shall be used in accordance with the manufacturer's recommendations. Cleaning procedure shall be performed on a designated test area and shall be approved prior to proceeding with cleaning work. Discolorations which cannot be removed by these procedures, shall be considered defective work. Cleaning work shall be done when temperature and humidity conditions are such that surfaces dry rapidly. Care shall be taken during cleaning operations to protect adjacent surfaces from damage.

3.4 PROTECTION OF WORK

Precast units shall be protected against damage from subsequent operations.

3.5 DEFECTIVE WORK

Precast concrete units damaged during erection shall be repaired as soon after occurrence as possible or replaced, as directed, using approved procedures. All repairs to precast concrete units shall match the adjacent surfaces in color and texture and shall be as approved. Unless otherwise approved, repair procedures shall conform to PCI Mnl-116 and PCI Mnl-117.

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SECTION 05055

WELDING, STRUCTURAL

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z49.1	(1988) Safety in Welding and Cutting

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT-01	(1988) Recommended Practice SNT-TC-1A

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1986) Symbols for Welding, Brazing and Nondestructive Examination
AWS A3.0	(1989) Standard Welding Terms and Definitions
AWS D1.1	(1990) Structural Welding Code - Steel

1.2 DEFINITIONS

Definitions of welding terms shall be in accordance with AWS A3.0.

1.3 GENERAL REQUIREMENTS

The design of welded connections shall conform to AISC S335 unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Welding shall be as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Welding shall not be started until welding procedures, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Qualification testing shall be performed at or near the work site. Each Contractor performing welding shall maintain records of the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

1.4 SUBMITTALS

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

1.4.1 SD-08, Statements

Welding Procedure Qualifications; GA.

Welder, Welding Operator, and Tacker Qualification; GA.

Inspector Qualification; GA.

Copies of the welding procedure specifications; the procedure qualification test records; and the welder, welding operator, or tacker qualification test records.

1.4.2 SD-18, Records

Quality Control; GA.

A quality assurance plan and records of tests and inspections.

1.5 WELDING PROCEDURE QUALIFICATIONS

Except for prequalified (per AWS D1.1) and previously qualified procedures, each Contractor performing welding shall record in detail and shall qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Qualification of welding procedures shall conform to AWS D1.1 and to the specifications in this section. Copies of the welding procedure specification and the results of the procedure qualification test for each type of welding which requires procedure qualification shall be submitted for approval. Approval of any procedure, however, will not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the requirements of these specifications. This information shall be submitted on the forms in Appendix E of AWS D1.1. Welding procedure specifications shall be individually identified and shall be referenced on the detail drawings and erection drawings, or shall be suitably keyed to the contract drawings. In case of conflict between this specification and AWS D1.1, this specification governs.

1.5.1 Previous Qualifications

Welding procedures previously qualified by test may be accepted for this contract without requalification if the following conditions are met:

a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.5.2 Prequalified Procedures

Welding procedures which are considered prequalified as specified in AWS D1.1 will be accepted without further qualification. The Contractor shall submit for approval a listing or an annotated drawing to indicate the joints not prequalified. Procedure qualification shall be required for these joints.

1.5.3 Retests

If welding procedure fails to meet the requirements of AWS D1.1, the procedure specification shall be revised and requalified, or at the Contractor's option, welding procedure may be retested in accordance with AWS D1.1. If the welding procedure is qualified through retesting, all test results, including those of test welds that failed to meet the requirements, shall be submitted with the welding procedure.

1.6 WELDER, WELDING OPERATOR, AND TACKER QUALIFICATION

Each welder, welding operator, and tacker assigned to work on this contract shall be qualified in accordance with the applicable requirements of AWS D1.1 and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used.

1.6.1 Previous Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without requalification if all the following conditions are met:

a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.

b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

c. The previously qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

d. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.6.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, the Contractor shall submit the names of the welders, welding operators, and tackers to be employed, and certification that each individual is qualified as specified. The certification shall state the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. The certification shall be kept on file, and 3 copies shall be furnished. The certification shall be kept current for the duration of the contract.

1.6.3 Renewal of Qualification

Requalification of a welder or welding operator shall be required under any of the following conditions:

a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.

b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.

c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified shall be submitted as evidence of conformance.

d. A tacker who passes the qualification test shall be considered eligible to perform tack welding indefinitely in the positions and with the processes for which he is qualified, unless there is some specific reason to question the tacker's ability. In such a case, the tacker shall be required to pass the prescribed tack welding test.

1.7 INSPECTOR QUALIFICATION

Inspection and nondestructive testing personnel shall be qualified in accordance with the requirements of ASNT-01 for Levels I or II in the applicable nondestructive testing method. The inspector may be supported by assistant welding inspectors who are not qualified to ASNT-01, and assistant inspectors may perform specific inspection functions under the supervision of the qualified inspector.

1.8 SYMBOLS

Symbols shall be in accordance with AWS A2.4, unless otherwise indicated.

1.9 SAFETY

Safety precautions during welding shall conform to ANSI Z49.1.

PART 2 PRODUCTS

2.1 WELDING EQUIPMENT AND MATERIALS

All welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator performing qualified welding procedures. All welding equipment and materials shall comply with the applicable requirements of AWS D1.1.

PART 3 EXECUTION

3.1 WELDING OPERATIONS

3.1.1 Requirements

Workmanship and techniques for welded construction shall conform to the requirements of AWS D1.1 and AISC S335. When AWS D1.1 and the AISC S335 specification conflict, the requirements of AWS D1.1 shall govern.

3.1.2 Identification

Welds shall be identified in one of the following ways:

a. Written records shall be submitted to indicate the location of welds made by each welder, welding operator, or tacker.

b. Each welder, welding operator, or tacker shall be assigned a number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. For seam welds, the identification mark shall be adjacent to the weld at 3-foot intervals. Identification with die stamps or electric etchers shall not be allowed.

3.2 QUALITY CONTROL

Testing shall be done by an approved inspection or testing laboratory or technical consultant, or if approved by the Contracting Officer, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. The Contractor shall perform visual ultrasonic inspection to determine conformance with paragraph: STANDARDS OF ACCEPTANCE. Procedures and techniques for inspection shall be in accordance with applicable requirements of AWS D1.1, except that in radiographic inspection only film types designated as "fine grain," or "extra fine," shall be employed.

3.3 STANDARDS OF ACCEPTANCE

Dimensional tolerances for welded construction, details of welds, and quality of welds shall be in accordance with the applicable requirements of AWS D1.1 and the contract drawings. Nondestructive testing shall be by visual inspection ultrasonic. The minimum extent of nondestructive testing shall be random 10 percent of welds or joints, as indicated on the drawings.

3.3.1 Nondestructive Examination

The welding shall be subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or shop will not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification requirements, the Government reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment.

3.4 DESTRUCTIVE TESTS

When metallographic specimens are removed from any part of a structure, the Contractor shall make repairs. The Contractor shall employ qualified welders or welding operators, and shall use the proper joints and welding procedures, including peening or heat treatment if required, to develop the full strength of the members and joints cut and to relieve residual stress.

3.5 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The costs of such inspection and testing will be borne by the Contractor if unsatisfactory welds are discovered, or by the Government if the welds are satisfactory. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph: STANDARDS OF ACCEPTANCE.

3.6 CORRECTIONS AND REPAIRS

When inspection or testing indicates defects in the weld joints, the welds shall be repaired using a qualified welder or welding operator as applicable. Corrections shall be in accordance with the requirements of AWS D1.1 and the specifications. Defects shall be repaired in accordance with the approved procedures. Defects discovered between passes shall be repaired before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, the affected area shall be blended into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before rewelding, the area shall be examined by suitable methods to insure that the defect has been eliminated. Repair welds shall meet the inspection requirements for the original welds. Any indication of a defect shall be regarded as a defect, unless reevaluation by nondestructive methods or by surface conditioning shows that no unacceptable defect is present.

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SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC M016	(1989; 9th Ed) Manual of Steel Construction ASD
AISC S302	(Feb 1987) Code of Standard Practice for Steel Buildings and Bridges
AISC S329	(Jul 1986) Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts
AISC S335	(1989) Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.21.1	(1990) Lock Washers

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6	(1990a) Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
ASTM A 36	(1991) Structural Steel
ASTM A 53	(1990b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 307	(1991) Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A 325	(1991c) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 500	(1990a) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A 501	(1989) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 563	(1991c) Carbon and Alloy Steel Nuts
ASTM F 844	(1990) Washers, Steel, Plain (Flat), Unhardened for General Use

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B46.1	(1985) Surface Texture (Surface Roughness, Waviness and Lay)

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1990) Structural Welding Code - Steel

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 25	(1982) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)

1.2 GENERAL REQUIREMENTS

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude. The Contractor shall be responsible for correctness of detailing, fabrication, and for the correct fitting of structural members. Substitution of sections or modification of connection details, or both, will not be accepted by the Government. Connections fully designed and detailed on the contract drawings shall be furnished as shown. Members and connections, for any part of the structure, not shown on the contract drawings shall be the Contractor's responsibility; such connections shall be considered standard and designed and detailed in accordance with AISC M016. The AISC S335 shall govern the work. Welding shall be in accordance with AWS D1.1. High-strength bolting shall be in accordance with the AISC S329.

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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-04, Drawings

Structural Steel; GA. Structural Connections; GA.

Detail drawings including all shop and erection details, and members (with their connections) not shown on the contract drawings. All welds shall be indicated by standard welding symbols of the AWS D1.1.

1.3.2 SD-08, Statements

Erection; GA.

Prior to erection, an erection plan of the structural steel framing is required. This erection plan shall conform to the requirements of the AISC S302. The erection plan shall describe all necessary temporary supports, including the sequence of installation and removal.

1.3.3 SD-13, Certificates

Materials and Welders; GA. Fabrication; GA.

Certified copies of mill test reports for structural steel, structural bolts, nuts, washers and other related structural steel items. Certified copies of welders qualification test records showing qualification in accordance with AWS D1.1. A copy of the AISC certificate indicating that the fabrication plant meets the specified structural steelwork category.

1.3.4 SD-14, Samples

High Strength Bolts; GA. Carbon Steel Bolts; GA. Carbon Steel Nuts; GA. Washers; GA.

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

1.4 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

2.1.1 Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36.

2.2 STRUCTURAL TUBING

Structural tubing shall conform to ASTM A 500, Grade B, and ASTM A 501.

2.3 STEEL PIPE

Steel pipe shall conform to ASTM A 53, Type E, Type S, Grade B.

2.4 HIGH-STRENGTH BOLTS

High-strength bolts shall conform to ASTM A 325 including nuts and washers.

2.5 CARBON STEEL BOLTS

Carbon steel bolts shall conform to ASTM A 307, Grade A.

2.6 CARBON STEEL NUTS

Carbon steel nuts shall conform to ASTM A 563, Grade A, Hex Style.

2.7 WASHERS

Plain washers shall conform to ASTM F 844. Other types, when required, shall conform to ANSI B18.21.1.

2.8 PAINT

Paint shall conform to SSPC Paint 25.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of the AISC S335. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be qualified under the AISC quality certification program for Category I structural steelwork. Compression joints depending on contact bearing shall have a surface roughness not in excess of 500 micro inches as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6.

3.2 ERECTION

Erection of structural steel shall be in accordance with the applicable provisions of the AISC S335.

3.2.1 Connections

Anchor bolts and other connections between the structural steel and foundations shall be provided and shall be properly located and built into connecting work.

3.2.2 Base Plates and Bearing Plates

Column base plates for columns and bearing plates for beams, girders, and similar members shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned, but prior to placing superimposed loads. Separate setting plates under column base plates will not be permitted. The area under the plate shall be damp-packed solidly with bedding mortar, except where expansive grout is indicated on the drawings. Bedding mortar and grout shall be as specified in SECTION: CAST-IN-PLACE CONCRETE.

3.2.3 Field Welded Connections

Field welded structural connections shall be completed before load is applied.

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SECTION 05300

STEEL DECKING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-673	(1986; Addenda 1989; Errata Nov 30, 1990) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 446	(1991) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
ASTM A 525	(1991b) General Requirement for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 611	(1991) Steel, Sheet, Carbon, Cold-Rolled, Structural Quality
ASTM A 792	(1989) Steel Sheet, Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM C 423	(1990a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 795	(1991) Mounting Test Specimens During Sound Absorption Tests

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1990) Structural Welding Code - Steel
AWS D1.3	(1989) Structural Welding Code - Sheet Steel

STEEL DECK INSTITUTE (SDI)

SDI-02	(1987; 2nd Ed) Diaphragm Design Manual

SDI Pub No 28	(1991) Design Manual for Composite Decks, Form Decks, Roof Decks and Cellular Metal Floor Deck with Electrical Distribution

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: SUBMITTAL DESCRIPTIONS.

1.2.1 SD-01, Data

Deck Units; GA.

Design computations for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications.

1.2.2 SD-04, Drawings

Deck Units; GA. Accessories; GA. Attachments; GA. Holes and Openings; GA.

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of welded or fastener connections; and the manufacturer's erection instructions.

1.2.3 SD-13, Certificates

Deck Units; GA. Attachments; GA.

Manufacturer's certificates attesting that the decking material meets the specified requirements. Manufacturer's certificate attesting that the operators are authorized to use the low-velocity piston tool.

1.2.4 SD-14, Samples

Deck Units; GA. Accessories; GA.

A 2 sq. ft. sample of the decking material to be used shall be furnished, along with a sample of each of the accessories used. A sample of acoustical material to be used shall be furnished.

1.2.5 SD-18, Statements

Attachments; GA.

Prior to welding operations, copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators.

1.3 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated, and stored under a weathertight covering permitting good air circulation. Finish of deck units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

PART 2 PRODUCTS

2.1 DECK UNITS

Deck units shall conform to SDI Pub No 28. Panels of maximum possible lengths shall be used to minimize end laps. Fabricate deck units in lengths to span 3 or more supports with flush, telescoped, or nested 2-inch laps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI SG-673, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

2.1.1 Roof Deck

Steel deck used in conjunction with insulation and built-up roofing shall conform to ASTM A 446, ASTM A 611 or ASTM A 792. Roof deck units shall be fabricated of the steel design thickness required by the design drawings and shall be G60 galvanized steel.

2.1.2 Acoustical Deck Units

Deck shall have a noise reduction coefficient of .85 when measured in accordance with ASTM C 423 using ASTM E 795 Mounting Type F-25. Sound absorbing materials shall be either glass fiber in roll or premolded form for acoustical steel deck (noncellular) or glass fiber rigid strip for acoustical steel deck (cellular) in accordance with manufacturer's standards. Acoustical decking to be in according to test ASTM C 423 by Riverbank Acoustical Labs.

2.1.3 Composite Deck

Deck used as part of a composite deck assembly shall conform to ASTM A 446 or ASTM A 611. Deck used as the tension reinforcing in composite deck shall be fabricated of the steel design thickness required by the design drawings, and shall be zinc-coated in conformance with ASTM A 525, G60 coating class. Deck units used in composite deck shall have adequate embossment to develop mechanical shear bond to provide composite action between the deck and the concrete.

2.1.4 Form Deck

Deck used as a permanent form for concrete shall conform to ASTM A 446 or ASTM A 611. Deck used as a form for concrete shall be fabricated of the steel design thickness required by the design drawings, and shall be zinc-coated in conformance with ASTM A 525, G60 coating class.

2.1.5 Sump Pans

Sump pans shall be provided for roof drains and shall be minimum 0.0747 inch thick steel, recessed type. Sump pans shall be shaped to meet roof slope by the supplier or by a sheet metal specialist. Bearing flanges of sump pans shall overlap steel deck a minimum of 3 inches. Opening in bottom of pan shall be shaped, sized, and reinforced to receive roof drain.

2.2 ADJUSTING PLATES

Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be the same thickness and configuration as the deck units.

2.3 CLOSURE PLATES

2.3.1 Closure Plates for Roof Deck

Voids above interior walls shall be closed with sheet metal where shown. Open deck cells at parapets, end walls, eaves, and openings through roofs shall be closed with sheet metal. Sheet metal shall be same thickness as deck units. Unless otherwise indicated on drawings.

2.3.2 Closure Plates for Composite Deck

The concrete shall be supported and retained at each floor level. Provide edge closures at all edges of the slab of sufficient strength and stiffness to support the wet concrete. Metal closures shall be provided for all openings in composite steel deck 1/4 inch and over, including but not limited to:

2.3.2.1 Cover Plates to Close Panels

Cover plates to close panel edge and end conditions and where panels change direction or abut. Butt joints in composite steel deck may receive a tape joint cover.

2.3.2.2 Column Closures to Close Openings

Column closures to close openings between steel deck and structural steel columns.

2.3.2.3 Sheet Metal

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.4 ACCESSORIES

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 0.0474 inch; welding washers, 0.0598 inch; cant strip, 0.0295 inch; other metal accessories, 0.0358 inch; unless

otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

PART 3 EXECUTION

3.1 ERECTION

Erection of deck and accessories shall be in accordance with SDI Pub No 28 and the approved detail drawings. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or any deformations shall not be installed. The deck units shall be placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place. The deck shall not be filled with concrete, used for storage or as a working platform until the units have been secured in position. Shoring shall be in position before concrete placement begins in composite or form deck. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended directly from the steel deck. Acoustical material shall be neatly fitted into the rib voids.

3.2 SHORING

Shoring requirements for placing and curing of concrete in the composite floor deck assemblies shall be as shown.

3.3 ATTACHMENTS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be welded with nominal 5/8 inch diameter puddle welds to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No 28. All welding of steel deck shall be in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the steel deck being used. Welds shall be made only by operators previously qualified by tests prescribed in AWS D1.3 to perform the type of work required. Welding washers shall not be used at the connections of the deck to supports. Welding washers shall not be used at sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped 2 inches. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI-02. Powder-actuated fasteners shall be driven with a low-velocity piston tool by an operator authorized by the manufacturer of the piston tool. Pneumatically driven fasteners shall be driven with a low-velocity fastening tool and shall comply with the manufacturer's recommendations. Shear connectors shall be attached as shown and shall be welded as per AWS D1.1 through the steel deck to the steel member.

3.4 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings, specifications, and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 6 inches across require no reinforcement. Holes and openings 6 to 12 inches across shall be reinforced by 0.0474-inch thick steel sheet at least 12 inches wider and longer than

the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inches on center. Holes and openings larger than 12 inches shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.

3.5 PREPARATION OF FIRE-PROOFED SURFACES

Deck surfaces, both composite and noncomposite, which are to receive sprayed-on fireproofing, shall be galvanized and shall be free of all grease, mill oil, paraffin, dirt, salt, and other contaminants which impair adhesion of the fireproofing. Any required cleaning shall be done prior to steel deck installation using a cleaning method that is compatible with the sprayed-on fireproofing.

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SECTION 05500

MISCELLANEOUS METAL

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1991) Structural Steel
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 139	(1990) Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over)
ASTM A 284	(1984) Specification for Low and Intermediate Tensile Strength Carbon - Silicon Steel Plates for Machine Parts and General Construction
ASTM A 307	(1991) Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A 446	(1991) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
ASTM A 475	(1989) Zinc-Coated Steel Wire Strand
ASTM A 501	(1989) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 525	(1991b) General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1990) Structural Welding Code - Steel
AWS D1.2	(1990) Structural Welding Code - Aluminum

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: SUBMITTAL DESCRIPTIONS.

1.2.1 SD-04, Drawings

Miscellaneous Metal Items; GA.

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: perforated metal gates, shade trellis assemblies at entrances to building, ramada structures, custom door/window frames, signage, trellises and perforated window grillage.

The above list of shop drawings is to be considered only as a guide and not as a complete bill of material. The Contractor is still responsible for reviewing the drawings.

1.2.2 SD-14, Samples

Miscellaneous Metal Items; GA.

Samples shall be full size, taken from manufacturer's stock, and shall be complete as required for installation in the structure. After approval, samples may be installed in the work, provided each sample is clearly identified and its location recorded. Samples of the following items, one of each type: all perforated steel, stainless steel, composite trellis support (2'-0") long, all fastening devices and cable restraint assemblies.

1.3 DELIVERY

When problems of shipment, handling and installation require fabrication in sections, provide for field fitting and welding.

1.4 HANDLING AND STORAGE

Handle steel with care to avoid bending, twisting or other damage. Unloading shall be under supervision of General Contractor. Blocking shall be placed to keep steel off ground. Steel shall be stored to allow drainage of water from all parts and totally protected from moisture.

1.5 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 to be sandblasted and left to naturally weather should be blasted to a depth such as to remove all mill scale and have a uniform surface texture. 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 446, or ASTM A 525, 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.

1.6 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.

1.7 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.

1.8 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 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.

2.2 WINDOW GRATINGS AND FRAMES

2.2.1 Steel Section

Materials shall conform to the following Standards of the American Society for Testing Materials, latest edition; structural steel, except tubular sections, ASTM A 36; square, rectangular and special tubular sections, ASTM A 501; plates and bars; ASTM A 284.

2.2.2 Perforated Steel

Materials shall conform to the standards of the American Society for Testing Materials latest edition. Perforated steel to be .375 round perforations at .563 o.c., staggered centers.

2.2.3 Connections

Unfinished bolts; ASTM A 307, Grade A. Arc welding electrodes; ASTM A 139 low hydrogen.

2.2.3.1 The window security gratings and frames as shown on the construction drawing details. They shall be fabricated of A36 carbon steel with a light sandblasted finish. All welded connections as called out in specs and drawings. All mechanical fastening to be with stainless steel fittings, screws and bolts. All perforated carbon steel sheets to be 16 gauge with holes of 3/8" diameter, 9/16" staggered center, mill finish, 40 percent open area.

2.3 HANDRAILS

Handrails 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 and fabricated according to the project's construction drawings.

2.3.1 Steel handrails as shown on the drawings shall be stainless steel pipe US32 finish.

2.4 CABLES AT ENTRY RAMP

Rail cables shall be pre-stretched, 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 rope-end fitting, a factory-attached, open-bridge strand socket bottom-end fitting, and shall be complete with oval-eye, threaded anchor rods. Fittings and accessories shall be hot-dip galvanized. Cables with burrs or rough sections shall be subject to the approval of the Contracting Officer.

2.5 TRELLISES AND RAMADAS

The trellises and ramadas to be as shown on the construction drawings and details. They shall be fabricated of A36 carbon steel with a light sandblasted finish. All welded connections as called out in specs and drawings. All mechanical fastening to

be with stainless steel fittings, screws and bolts. All perforated carbon steel sheets to be 10 gauge with holes of 3/8" diameter, 9/16" staggered center, 4 holes psi 40% o/a.

2.6 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 as shown on the construction drawings.

2.7 STEEL STAIRS

Steel stairs shall be complete with structural or formed channel stringers, metal-pan cement-filled treads, landings, columns, handrails, and necessary bolts and other fastenings as indicated on the construction drawings. Structural steel shall conform to ASTM A 36.

2.8 STEEL DOOR FRAMES

Steel door frames shall be neatly mitered and securely welded at the corners with all welds ground smooth. Provision shall be made to stiffen the top member for all spans over 3 feet. Provision should be made for exposed fastening of frames into concrete.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Item 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 ATTACHMENT OF HANDRAILS

Toeboards and brackets shall be installed where indicated. Splices where required, shall be made at expansion joints. Removable sections shall be installed as indicated. Handrails shall conform to details of construction drawings.

3.4 ERECTION OF GUY CABLES

Guy cables at railings shall be erected as indicated on construction drawings. Anchor rods shall be cast in concrete located and reinforced as shown.

3.5 DOOR FRAMES

Door frames shall be secured to the floor slab 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.

3.6 WINDOW GRATING AND FRAMES

a. Fabricate miscellaneous metal items in accordance with AISC Specifications and as indicated on the Shop Drawings. Properly mark and matchmark all materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling.

b. Coordinate with other trades to verify conditions of related work. Secure templates (as necessary) for items attaching to miscellaneous metal work and provide proper arrangements. Supply miscellaneous metal work items which require embedment to other sections as required.

c. All work shall be true, plumb and straight and in complete accord with the plans and the approved Shop Drawings. All exposed welded joints to be continuous and ground smooth, lease sharp edges to eliminate knife-like edges. Do all necessary fitting in the field to make all joints smooth and right. All bolting, anchoring, riveting, splicing, etc., shall be exactly as shown on Shop Drawings.

d. Verify all dimensions and conditions in the field before commencing with fabrication. Report any discrepancies or unsatisfactory conditions immediately and install no work until conditions are corrected.

3.6.1 Erection

a. Provide temporary shoring and bracing as required, with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy a lines to achieve proper alignment of the structure as erection proceeds, as required.

b. Furnish anchor bolts and other connections required for securing steel items in place. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

c. Prior to setting base plates, clean concrete bearing surfaces and roughen to improve bond. Clean the bottom surface of base plates.

1. Set loose and attached base plates for steel members on wedges or other adjustable devices.

2. Tighten anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base plate prior to packing with mortar.

3. Pack bedding mortar solidly between bearing surfaces and bases or plates to ensure that no voids remain.

4. Finish exposed surfaces, protect installed materials, and allow to cure.

3.7 FINISHES ON CARBON STEEL

Provide all non-exposed structural steel with one coat of red primer. Provide all exposed architectural/structural steel with a light sandblasted finish to remove all mill scale and present a uniform texture. Interior and exterior sandblasted steel should be pre-weathered as approved by the Contracting Officer. Prior to pre-weathering of steel the Contractor shall remove markings, oil, grease, etc., as required to obtain a uniform appearance of rust.

3.8 ALTERNATING EXISTENCE CHAIN-LINK FENCE

Existing chain-link fence along Skunk Channel shall be cut and welded, according to AWS D1.2, as described by the drawings.

3.9 FOLLOW UP

As work progresses, make any adjustments to the previously installed work, which are required for the related work of other trades to proceed. Immediately after erection, clean field welds, bolted connections and abraded areas and sandblast or polish as required.

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SECTION 06100

ROUGH CARPENTRY

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 PLYWOOD ASSOCIATION (APA)

APA-01	(Mar 1991) Source List - Adhesives for APA Glued Floor System

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 307	(1991) Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM C 79	(1991) Gypsum Sheathing Board
ASTM C 518	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Floor Meter Apparatus
ASTM C 578	(1987a) Preformed, Cellular Polystyrene Thermal Insulation
ASTM C 665	(1988) Mineral-Fiber Blanket Thermal Insulation for Light Frame Consruction and Manufactured Housing

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1	(1983) Construction and Industrial Plywood

FEDERAL SPECIFICATIONS (FS)

FS FF-N-105	(Rev B; Am 3; Int Am 4) Nails, Brads, Staples and Spikes: Wire, Cut and Wrought
FS HH-I-558	(Rev B; Am 3) Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type)

FS HH-I-1972/GEN	(Basic; Am 1; Notice 1) Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate

NATIONAL FOREST PRODUCTS ASSOCIATION (NFOPA)

NFOPA-01	(Nov 1991; Supple) National Design Specification for Wood Construction
NFOPA-02	(1988) Manual for Wood Frame Construction

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17	(1991) Standard Grading Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01	(Sep 1, 1991) Western Lumber Grading Rules 91

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: SUBMITTAL DESCRIPTIONS.

1.2.1 SD-13, Certificates

Grading and Marking; GA.

Manufacturer's certificates attesting that lumber and material not normally grade marked or exempt from being grade marked meets the specified requirements.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 LUMBER AND SHEATHING

2.1.1 Grading and Marking

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 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 species used. Except for plywood, and lumber; bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Moisture Content

At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

a. Treated and Untreated Lumber Except Roof Planking:

4 inches or less, nominal thickness	19 percent maximum
5 inches or more, nominal thickness	23 percent maximum

2.1.4 Structural and Miscellaneous Wood Members

2.1.4.1 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
Corner bracing	1 by 4.
Furring	1 by 3.
Grounds	Plaster thickness by 1-1/2.
Nailing strips	1 by 3 or 1 by 4 when used as shingle base or interior finish, otherwise 2-inch stock.

2.1.4.2 Interior Walls and Partitions

Standard 25 ga. metal screw studs in sizes as indicated on the drawings, zinc coated and spaced at 16" o.c. unless otherwise noted. Standard floor and ceiling stud tracks and type "S" pan head 3/8" screws.

2.1.4.3 Miscellaneous Metal Framing and Furring

Standard metal screw and joists in the sizes shown or indicated complete with all necessary screws, fasteners, etc., for a satisfactory and structurally sound installation.

2.1.5 Sheathing

Sheathing shall be gypsum board, plywood, or wood for wall sheathing; and plywood, or wood for roof sheathing.

2.1.5.1 Gypsum Board

Gypsum board shall conform to ASTM C 79, 1/2 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, 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.

2.2 ACCESSORIES AND NAILS

Accessories and nails shall conform to the following:

2.2.1 Adhesive

APA-01.

2.2.2 Anchor Bolts

ASTM A 307, size as indicated, complete with nuts and washers.

2.2.3 Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws

Type, size, and finish best suited for intended use.

2.2.4 Clip Angles

Steel, 3/16 inch thick, size best suited for intended use; or zinc-coated steel or iron commercial clips designed for connecting wood members.

2.2.5 Expansion Shields

Type and size best suited for intended use.

2.2.6 Nails and Staples

FS FF-N-105, size and type best suited for purpose. For sheathing and subflooring, length of nails shall be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 1-inch thick lumber and for toe nailing 2-inch thick lumber; 16-penny or larger nails shall be used for nailing through 2-inch thick lumber. Nails used with treated lumber and sheathing shall be galvanized.

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 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. Insulation shall conform to the following:

2.3.1 Batt or Blanket

Mineral fiber, ASTM C 665, Type I, width as required for wood construction.

2.3.2 Rigid Insulation

a. Polystyrene, ASTM C 578.

b. Mineral fiber, FS HH-I-558, Form A, Class 1.

c. Polyurethane or polyisocyanurate, FS HH-I-1972/GEN.

PART 3 EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS

3.1.1 General

Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. Nailing shall be in accordance with the recommended Nailing Schedule as contained in NFOPA-02. Where detailed nailing requirements are not specified, nail size and nail spacing shall be sufficient to develop an adequate strength for the connection without splitting the members. Installation of timber connections shall conform to applicable requirements of NFOPA-01. Members shall be framed for passage of ducts and pipes shall be cut, notched, or bored in accordance with applicable requirements of NFOPA-02.

3.1.2 Partition and Wall Framing

Unless otherwise shown, studs shall be spaced 16 inches on centers. Studs shall be doubled at openings. Unless otherwise indicated, headers for openings shall be made of two pieces of stud material set on edge or solid lumber of equivalent size, and corners shall be constructed of not less than three full members. End studs of partitions abutting concrete or masonry shall be anchored thereto with expansion bolts, one near each end of each stud and at intermediate intervals of not more than 4 feet. Plates of partitions resting on concrete floors shall be anchored in place

with expansion bolts, one near each end of each piece and at intermediate intervals of not more than 6 feet between bolts. In lieu of expansion bolts, anchoring into concrete may be accomplished with powder-driven threaded studs of suitable type and size and spaced at 3 feet on center. Walls and load bearing partitions shall be provided with double top plates with members lapped at least 2 feet and well spiked together. Blocking for firestopping shall be provided so that maximum dimension of any concealed space is not over 8 feet. Corner bracing shall be installed when required by type of sheathing used or when siding, other than panel siding, is applied directly to studs. Corner bracing shall be let into the exterior surfaces of the studs at an angle of approximately 45 degrees, shall extend completely over wall plates, and shall be secured at each bearing with two nails.

3.1.3 Walls

For partitions on track systems, the Contractor shall accurately align metal track at floor and ceiling. Anchor track using power driven anchors at 24" o.c. Position studs with flanges all facing in the same direction. Secure all framing together and to runners with Type "S" screws or other approved fasteners as recommended by stud manufacturer. Frame around all doors and other openings as required using a double stud at jambs. Cut members to length for continuous span overhead of openings. Extend framing for interior partitions at 4" above finished ceiling unless otherwise noted. Provide diagonal bracing at tops of walls and secure to underside of structure. In general follow manufacturer's recommendations for setting, spacing and fastening of studs and related accessories.

3.1.4 Blocking

Blocking shall be provided as necessary for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide fire stopping. Blocking shall be cut to fit between framing members and rigidly nailed thereto. Miscellaneous blocking shall be provided as required, including, but not limited to, blocking for handrails and handicap grab bars, wall mounted lockers, wall mounted telephone enclosure, fire extinguisher cabinets, and drinking fountains.

3.1.5 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.

3.1.6 Rough Bucks and Frames

Rough bucks shall be set straight, true, and plumb, and secured with anchors near top and bottom of each wood member and at intermediate intervals of not more than 3 feet. Anchors for concrete shall be expansion bolts, and anchors for masonry shall be 3/16-inch by 1-1/4 inch steel straps extending not less than 8 inches into the masonry and turned down 2 inches into the masonry.

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 and Structural-Use Panels

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. Nailing of edges shall be 3/8 inch from the edges. Wall sheathing shall extend over top and bottom plates, and if applied horizontally the vertical joints shall be made over supports and staggered. Wall sheathing over which wood shingles are to be applied shall be applied horizontally. Roof sheathing shall be applied with long dimension at right angles to supports, end joints made over supports, and end joints staggered.

3.3 INSTALLATION OF VAPOR RETARDER

Vapor retarder shall be applied to provide a continuous barrier at window and door frames, and at all penetrations such as electrical outlets and switches, plumbing connections, and utility service penetrations. Joints in the vapor retarder shall be lapped and sealed according to the manufacturer's recommendations.

3.4 INSTALLATION OF INSULATION

Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the R-values described in paragraph: Insulation. 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.

TABLE I. SPECIES AND GRADE

Subflooring, Roof Sheathing, Wall Sheathing, Furring

Grading Rules	Species	Standard	Const Comm	No. 2 Board	No. 2 Comm	No. 3 Comm
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					

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SECTION 06200

FINISH CARPENTRY

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.

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI-02	(5th Ed) Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1	(1983) Construction and Industrial Plywood

FEDERAL SPECIFICATIONS (FS)

FS FF-N-105	(Rev B; Int Am 4) Nails, Brads, Staples and Spikes: Wire, Cut and Wrought

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: SUBMITTAL DESCRIPTIONS.

1.2.1 SD-04, Drawings

Finish Carpentry; GA.

Drawings shall show fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

1.2.2 SD-14, Samples

Maple Plywood Sidings; FIO. Maple Solid Stock Moldings; FIO.

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 WOOD ITEMS, SIDING, AND TRIM

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

2.1.4 Siding

Horizontal siding shall be hardboard, plywood, or wood. Panel siding shall be hardboard or plywood.

2.1.4.1 Panel Plywood Siding

Panel plywood siding shall conform to DOC PS 1, exterior interior medium-density overlay, 4 feet wide, maximum practicable lengths, span rating of 16 oc smooth as selected from manufacturer's standard patterns.

2.1.4.2 Backing Particle Board

Particle board for backing and/or substrates as indicated on the drawings shall be commercial grade, high density material hot presses and formed with waterproof binders. Furnish in standard sheet sizes and thicknesses as detailed.

2.1.4.3 Finish Plywood

Finish, veneered plywood for use as wall paneling or otherwise as indicated shall be premium grade with at least one face of clear, uniform, white maple veneer. The veneers shall be uniform in color and grain throughout the project and shall be consistent with the approved sample. The non-exposed face veneer may be one grade below premium but any locations with double exposure shall be premium grade both faces.

2.1.5 Moldings

Moldings shall conform to WMMPA WM 6 and as indicated on the drawings. Moldings shall be solid hard maple to be finished with all edges square and true.

2.1.6 Millwork Items

This section includes everything necessary for and incidental to the fabrication and completion of all millwork as indicated on the drawings and as specified herein. The completed items, components and pieces are to be furnished to SECTION: FINISH CARPENTRY for installation. All work within this section shall be done following the standards for "custom" quality of the "American Woodworking Institute" AWI-02, in so far as these standards apply to the various items.

2.1.6.1 Concealed framing shall be 3/4 inch APA A-A interior plywood or 3/4 inch commercial grade high density particle board.

2.1.6.2 All solid stock wood trim, including veneers, shall be clear uniform hard maple thoroughly seasoned and graded for appearance application. The material shall be uniform in color and grain throughout and shall be consistent with the approved sample. The material shall be free of knots, splits, cracks, warping or other deficient characteristics.

2.1.6.3 Finish, veneer plywood for use as door, drawer faces and exposed surfaces otherwise as indicated shall be premium grade with at least one face of clear, uniform, white maple veneer. The veneer shall be uniform in color and grain throughout the project and shall be consistent with the approved sample. The non-exposed face veneer may be one grade below premium but any locations with double exposure shall be premium grade both faces.

2.1.6.4 Edge banding shall be 3/32" solid maple and fastened to edges of sheets with white wood glue and 3/4" minimum finish nails with holes filled with appropriate filler to match surface color of maple after finishing. Orient edge banding strips to conceal end grain from visual exposure. Edge banding "tape" products will not be accepted for edge banding.

2.1.6.5 Finish hardware and accessories required for all millwork items shall be furnished by this section of the work. In general, unless otherwise noted, finish shall be brushed chrome.

a. Hinges: Gras, or equal, blind concealed, self-closing hinges.

b. Pulls: 3-1/2" brushed chrome wire pulls.

c. Drawer Slides: Accuride, or equal.

d. Feld door guards.

e. Adjustable shelf devices: Knape and Vogt Mfg. type #346 or equal.

2.1.6.6 All counter tops to be high pressure plastic laminate as per details on drawings.

2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to FS FF-N-105. 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 Installation of Siding

Siding shall be accurately fitted and positioned without springing or otherwise forcing siding in place. Siding to have a clear finish shall have nails set and stopped with nonstaining putty to match finished siding.

3.1.2 Panel Siding

Panels shall be applied with edges at joints spaced in accordance with manufacturer's recommendations and all edges shall be backed with framing members. Panels shall be nailed at edges at 6 inches on center and at intermediate supports at 12 inches on center. Nailing at edges shall be 3/8 inch from edges.

3.1.3 Edge Banding

Edge banding shall be 3/32" solid maple and fastened to edges of sheets with white wood glue and 3/4" minimum finish nails with holes filled with appropriate filler to match surface color of maple after finishing. Orient edge banding strips to conceal end grain from visual exposure. Edge banding "tape" products will not be accepted for edge banding.

3.2 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

3.3 MILLWORK ITEMS

All millwork items shall be fabricated in accordance with the approved shop drawings. It shall be the responsibility of this section to verify actual field conditions and dimensions before any fabrication commences. Methods of fabrication and assembly of the cabinets, unless specifically stated, shall be at the discretion of this section of the work, whose responsibility it shall be to guarantee satisfactory performance. All parts shall be free of defects which affect strength, rigidity or durability. All components shall be of sufficient strength to perform functions for which they are used. Door and drawer fronts shall be constructed in such a manner to assure non-warping. Finish sand all surfaces in preparation for finishing. All plugs shall be sanded flush with materials surface. All millwork items, exterior and interior, shall be finished at the point of manufacture (not in field) per the requirements of SECTION: PAINTING, GENERAL.

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SECTION 07220

ROOF INSULATION

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 272	(1980) Test Method for Water Absorption of Core Materials for Structural Sandwich Construction
ASTM C 518	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM D 41	(1985) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D 312	(1989) Asphalt Used in Roofing
ASTM D 696	(1991) Coefficient of Linear Thermal Expansion of Plastics Between Minus 30 degrees C and 30 degrees C
ASTM D 1621	(1973; R 1979) Compressive Properties of Rigid Cellular Plastics
ASTM D 1622	(1988) Apparent Density of Rigid Cellular Plastics
ASTM D 2126	(1987) Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM D 4586	(1986) Asphalt Roof Cement, Asbestos Free
ASTM E 84	(1991a) Surface Burning Characteristics of Building Materials
ASTM E 96	(1992) Water Vapor Transmission of Materials

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825	(1992; Supple I) Approval Guide

FEDERAL SPECIFICATIONS (FS)

FS FF-N-105	(Rev B; Int Am 4) Nails, Brads, Staples and Spikes: Wire, Cut and Wrought
FS HH-I-1972/GEN	(Basic; Am 1; Notice 1) Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate
FS HH-I-1972/2	(Basic; Am 1) Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Asphalt/Organic Felt, Asphalt/ Asbestos Felt or Asphalt/Glass Felt on Both Sides of the Foam
FS HH-I-1972/3	(Basic; Notice 1) Insulation Board, Thermal, Polyurethane or Polyisocyanurate Faced with Perlite Insulation Board on One Side and Asphalt/Organic Felt or Asphalt/Glass Fiber on the Other Side of the Foam

UNDERWRITERS LABORATORIES (UL)

UL-01	(1992) 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: SUBMITTAL DESCRIPTIONS.

1.2.1 SD-06, Instructions

Application of Insulation; GA.

Insulation manufacturer's recommendations for the application and installation of insulation.

1.2.2 SD-08, Statements

Contractor Quality Control; GA.

The CQC procedure for insulation installation prior to start of roof insulation work.

1.2.3 SD-13, Certificates

Insulation; GA. Glass Roofing Felt; GA. Organic Roofing Felt; FIO.

Certificates of compliance for insulation and felt materials.

1.3 STORAGE OF MATERIALS

Insulation, base sheet, and felt shall be kept dry at all times, before, during, or 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 at Contractor's expense. 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 the UL-01 or Class I in FM P7825, except for installation on poured concrete decks or precast concrete roof deck panels.

1.5 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.

PART 2 PRODUCTS

2.1 BITUMINOUS MATERIALS

Bituminous materials shall conform to the following requirements:

2.1.1 Asphalt Bitumen

ASTM D 312, Type III or IV. Asphalt flash point and equiviscous temperature (EVT) shall be indicated on bills of lading or on individual containers.

2.1.2 Asphalt Cement

ASTM D 4586, Type I.

2.1.3 Asphalt Primer

ASTM D 41.

2.2 INSULATION

Insulation shall be a standard product of the manufacturer and shall be factory marked with the manufacturer's name or trade mark, the material specification number, the R-value at 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-value shown on the drawings. The minimum thickness of tapered insulation shall be in accordance with the insulation manufacturer's recommendations for the substrate on which the tapered insulation is to be installed and shall not allow condensation within the insulation.

2.2.1 Properities of Insulation

Insulation shall be roof board insulation and will conform to the specifications of the roofing manufacturer for a valve of R-30 and an aged value of R-28. This R-value shall be guaranteed for 20 years from the date of purchase. Insulation shall not exceed 4" thickness. Insulation shall meet performance criteria as stated in FS HH-I-1972, and shall correspond to the following physical properties*:

Property	Test Method	Specification
Comprehensive (10% consolidation)	ASTM D 1621	25 psi
Dimensional (7 days 158 degrees F/95% R.H.)	ASTM D 2126	1.0% length 1.0% thickness 1.0% thickness
Thermal conductivity	ASTM C 518	0.12 ("k" value)
Water absorption, increase by volume (Two Hour immersion)	ASTM C 272	1.8%
Water vapor transmission	ASTM E 96	
a. desiccant method		1.4 Perms
b. water method		7.0 Perms
Density (nominal)	ASTM D 1622	2.5 lb/ft^3
Coefficient of linear thermal expansion	ASTM D 696	13x10 per degree F.
Surface burning characteristics (1/2" to 3" bare foam)	ASTM E 84	
a. flame spread		25 or less
b. smoke development		25 or less

*Typical average foam core values.

2.3 NAILS AND FASTENERS

Nails and fasteners shall conform to the following requirements:

2.3.1 Nails for Fastening Insulation to Flush Mounted Wood Nailers

FS FF-N-105, Type II, Style 20, of sufficient length to hold insulation securely in place.

2.3.2 Fasteners

Insulation manufacturer's recommendations except holding power when driven, shall be not less than 120 pounds each in steel deck.

2.3.3 Metal Disks

Flat and not less than 30 gauge thickness. Disks used with nails or fasteners for securing fiberboard insulation shall be minimum 1-inch diameter. Disks used with nails or fasteners for securing other board insulation shall be minimum 2-1/8 inches in diameter.

2.3.4 WOOD NAILERS

Wood nailers shall conform to SECTION: 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.

PART 3 EXECUTION

3.1 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 and dry at time of application.

3.2 HEATING OF ASPHALT

Asphalt shall not be heated higher than 75 degrees F above the EVT or 50 degrees F below the flash point, 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 insure that the maximum temperature is not exceeded. Asphalt shall be applied within a range 25 degrees F below to 25 degrees F 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.

3.3 APPLICATION OF INSULATION

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.

3.3.1 Mechanical Fastening

On steel decks, or any slope exceeding 1/2 inch per foot, the insulation shall be mechanically fastened. Method of attachment shall be in accordance with recommendations of the insulation manufacturer and requirements specified hereinafter.

3.3.2 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 two 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 30 pounds per square foot live load limit.

3.4 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control 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 before, during, and after installation.

d. Inspection of mechanical fasteners; type, number, length, and spacing.

e. Coordination with other materials, cants, sleepers, and nailing strips.

f. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.

g. Installation of cutoffs and proper joining of work on subsequent days.

h. Continuation of complete roofing system installation to cover insulation installed same day.

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SECTION 07530

ELASTOMERIC ROOFING (EPDM)

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 448	(1986) Sizes of Aggregate for Road and Bridge Construction
ASTM D 4637	(1987) Vulcanized Rubber Sheet Used in Single-Ply Roof Membrane

UNDERWRITERS LABORATORIES (UL)

UL 790	(1983) Tests for Fire Resistance of Roof Covering Materials

1.2 GENERAL REQUIREMENTS

Ethylene propylene diene monomer (EPDM) roofing shall be applied to the roof surfaces indicated. Roofing membrane shall be furnished in the largest sheets possible to minimize joints. Membrane, flashing, and adhesives shall be the standard products of a single manufacturer or as recommended by the roofing manufacturer. Membrane shall be free of any holes, lumps, and foreign material. Roofing operations shall be coordinated with sheet metal work so that flashings are installed to permit continuous roof-surfacing operations. Roofing operations shall also be coordinated with roof insulation work so that all insulation applied each day is weatherproofed the same day with the completed membrane.

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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-04, Drawings

Roofing System; GA.

Drawings showing size of sheets, position of sheets and splices, flashing details, nailing patterns for the sheets, expansion joint details and a plan for protection of the roofing membrane from damage until completion of work by other trades.

1.3.2 SD-06, Instructions

Installation; GA.

Manufacturer's instructions including preparation, installation and splicing of the elastomeric membrane and walkways.

1.3.3 SD-08, Statements

Protection Plan; GA.

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

Contractor Quality Control; GA.

The CQC procedure for the roof system installation. prior to start of the work.

1.3.4 SD-13, Certificates

Materials; GA.

Certificates of compliance attesting that the materials meet specification requirements. The certificates shall list the components required for the specified rating.

1.3.5 SD-14, Samples

Materials; GA.

Samples of the following materials shall be submitted:

Membrane	1 by 1 foot section
Adhesive	1 quart
Sealant	8 ounces
Splicing Cement	1 quart

1.4 PRODUCT DELIVERY AND STORAGE

Materials shall be delivered to the job site in the manufacturer's original, unopened packages, clearly marked with the manufacturer's name, brand name, and description of contents. Membrane flashing and adhesives shall be stored in clean, dry areas. Storage temperature for adhesives shall be between 60 degrees F and 80 degrees F. Ballast shall not be stored on the roof.

1.5 WARRANTY

Manufacturer's standard warranty for 10 years shall be furnished. Warranty shall provide for repair or replacement of the complete roofing system, including insulation and flashing, if deterioration is caused by defects in materials or workmanship.

1.6 FIRE AND WIND UPLIFT REQUIREMENTS

The completed roof system shall be rated Class A as determined by UL 790.

PART 2 PRODUCTS

2.1 ADHESIVES

Adhesives, splicing cements and sealants shall be as recommended by the roofing membrane manufacturer.

2.2 BALLAST

Ballast shall be smooth water-washed round stone with gradations conforming to ASTM D 448, sizes 2 or 4, or both, as recommended by the membrane manufacturer, except that pieces passing the 1/2-inch sieve shall not exceed 2 percent.

2.3 FLASHING

Flashing shall be of durable elastomeric material compatible with the membrane as recommended by the membrane manufacturer.

2.4 NAILS AND FASTENERS

Nails and fasteners shall be of the types and sizes best suited for the purpose and shall comply with roofing manufacturer's approved instructions.

2.5 EPDM MEMBRANE

EPDM membrane shall conform to ASTM D 4637, Type I, Class U or SR, 0.060-inch minimum thickness.

2.6 ACCESSORIES AND PIPE SEALS

Accessories and pipe seals shall be of types and sizes recommended by the roofing membrane manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

The entire substrate construction of any bay or section of the building shall be completed before roofing is begun. Insulation over which EPDM roofing is installed shall conform to SECTION: ROOF INSULATION. Surfaces on or against which membrane is applied shall be smooth, clean, and free from water, oil, grease, sharp edges and construction debris; all joints over 1/4-inch wide shall be sealed.

3.2 INSTALLATION

Installation shall be in accordance with the manufacturer's approved instructions, except as otherwise specified.

3.2.1 Flashing

Edges of membrane, projections through the roof and changes in roof planes shall be flashed. The splice between the flashing and the membrane shall be completed before bonding the flashing to vertical surfaces. The splice shall be sealed a minimum of 3 inches on each side of the fasteners which attach the membrane to nailers. The installed flashing shall be nailed at the top of the flashing a maximum of 12-inches on center under metal counter-flashing or cap. Factory prefabricated pipe seals shall be used where possible.

3.2.2 Expansion Joints

Expansion joints shall be covered using prefabricated joint covers or elastomeric flashing in accordance with the manufacturer's recommendations.

3.2.3 Membrane

Membrane shall be applied in accordance with the manufacturer's instructions and the following requirements. Membrane shall be spliced to adjoining sheets using minimum 3-inch wide laps. Direction of lap shall be such that water flows over lap. Membrane joints shall be free of wrinkles or fishmouth. Mating surfaces of joints shall be cleaned. Excess adhesive on splice edges shall be removed with solvents and joints made watertight. Joints shall be inspected over entire length after completion and defective areas resealed where necessary to provide a watertight installation. Damaged areas of membrane shall be removed and replaced with new materials, lapping underlying membrane by at least 3 inches on all sides.

3.2.4 Ballast

Ballast shall be applied as the membrane is installed to prevent wind uplift, except that seams and terminations shall be left uncovered until inspection. Membrane shall be protected from mechanical damage during ballast application. Size 2 ballast shall be applied at the rate of at least 13 pounds per square foot. Size 4 ballast shall be applied at the rate of at least 10 pounds per square foot.

3.2.5 Cutoffs

Cutoffs shall be installed if work is ended before roof section is complete. The insulation line shall be straightened using loose-laid cut insulation and the membrane shall be sealed to the roof deck. Flutes in metal decking shall be sealed off along the cutoff edge. Membrane shall be pulled free or cut to expose the insulation when resuming work, and cut insulation sheets used for fill-in shall be removed.

3.2.6 Protection of Finished Roofing

The Contractor shall provide protection of the roofing membrane from possible damage that may occur as a result of work by other trades. After completion of all work by other trades, the Contractor shall remove the protection and shall inspect the roof. Any damage shall be repaired in accordance with the recommendations of the roofing manufacturer.

3.3 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure to assure compliance of the installed elastomeric roofing with the contract requirements. The procedure shall include a checklist of points to be observed. 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 roofing workers; start and end time of various tasks; readiness of substrate for application of roofing.

b. Verification of compliance of materials before, during and after installation.

c. Inspection of insulation, nailers, flashings, penetrations and work requiring coordination with roofing.

d. Inspection of membrane placement, splicing, and anchoring.

e. Inspection of placement of ballast and walkways.

A roofing technician responsible directly to the Contractor and experienced in the construction of elastomeric roofing and related work shall perform the quality control functions and be on the site whenever roofing operations are in progress. 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.

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SECTION 07600

SHEET METALWORK, GENERAL

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	(1991) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM D 226	(1989) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

FEDERAL SPECIFICATIONS (FS)

FS UU-B-790	(Rev A; Int Am 1) Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction. Work shall be installed without waves, warps, buckles, fastening stresses or distortion and shall allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Exposed edges shall be hemmed. Bottom edges of exposed vertical surfaces shall be angled to form drips. Flashing at the end of a run shall be formed into a three dimensional configuration to direct water to the outside of the system. Joints shall be installed as specified in TABLE 3. Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided. Roof flanges of sheet metal shall be set in bituminous cement over built-up roofing or shall be woven into shingle roofing before nailing. Application of bituminous strip flashing over roof flanges of various sheet metal items is covered in SECTION: ELASTOMERIC ROOFING (EPDM). Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations. Factory-fabricated components shall be packed in cartons marked with the manufacturer's name or trademark. Bulk materials from which items are field fabricated shall have manufacturer's name or trademark printed or embossed at frequent intervals to permit easy identification. Sheet metalwork pertaining to heating, ventilating, and air conditioning is specified in other sections.

1.3 SUBMITTALS

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

1.3.1 SD-04, Drawings

Sheet Metal; GA.

Drawings showing weights, gauges, or thickness of sheet metal; type of material; joining, expansion-joint spacing, and fabrication details; and installation procedures. Materials shall not be delivered to the site until after the approved detail drawings have been returned to the Contractor.

1.3.2 SD-08, Statements

Contractor Quality Control; F1O.

Quality Assurance Plan, including a checklist of points to be observed, prior to start of roofing work.

1.3.3 SD-14, Samples

Materials; GA.

Samples of materials proposed for use, upon request.

1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, weathertight, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the requirements specified below, and those given in TABLE 1.

2.1.1 Fasteners

Materials shall conform to TABLE 2. Fasteners shall be the best type for the application.

2.1.2 Felt

ASTM D 226, Type I.

2.1.3 Plastic Hardsetting Sealant

As recommended by aluminum manufacturer.

2.1.4 Sheet Metal

2.1.4.1 Carbon Grade Steel

Sheet metal to be carbon grade steel as detailed.

2.1.4.2 Stainless Steel

Corrosion-resisting steel, hereinafter referred to as "stainless steel"; ASTM A 167, Type 302 or 304; fully annealed, dead soft temper.

2.1.5 Slip Sheet

FS UU-B-790, Type I, Style 1b, Grade A.

2.2 SEALANTS AND SEALING COMPOUNDS

Sealants and sealing compounds referred to hereinafter are specified in SECTION: CAULKING AND SEALANTS.

PART 3 EXECUTION

3.1 PROTECTION OF CARBON GRADE STEEL

Carbon Grade Steel shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Carbon Grade Steel 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 the following method:

3.1.1 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and shall be cemented to the Carbon Grade Steel surface using a cement compatible with Carbon Grade Steel.

3.2 RIVETING, SEAMING, AND SEALING

3.2.1 Riveting and Sealing

Joints in Carbon Steel or Stainless Steel sheets 0.040 inch or less in thickness shall be made mechanically and sealed with the sealant specified.

3.2.2 Seams

Unsoldered plain-lap seams shall lap not less than 3 inches unless otherwise specified. Flat seams shall be made in the direction of the flow.

3.3 COVERING ON MINOR FLAT, PITCHED, OR CURVED SURFACES

Unless otherwise specified or indicated, all minor flat, pitched, or curved surfaces, such as crickets, bulkheads, dormers, and small decks, shall be covered or flashed with 18- by 24-inch metal sheets and secured with cleats. One ply of felt covered with one ply of slip sheet shall be applied as underlayment on wood surfaces. Two cleats shall be placed on the long side and one cleat shall be placed on the short side. Seams in materials other than aluminum shall be locked and soldered.

3.4 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints shall be spaced approximately 1/8-inch apart. The cleat shall be fastened to the supporting construction with nails evenly spaced not over 12 inches on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry. The cleat for fascia anchorage shall be installed to extend below the supporting construction to form a drip and to allow the flashing to be hooked over the lower edge at least 3/4 inch. The cleat shall be of sufficient width to provide adequate bearing area to insure a rigid installation. Where horizontal nailer is vented for insulation and the cleat is placed over masonry or concrete, the cleat shall be installed over 1/16-inch thick metal washers placed at screws. Washers shall be of metal that is electrolytically compatible with the continuous cleat.

3.5 EXPANSION JOINTS

Expansion joints shall be provided at 40-foot intervals for Stainless Steel and Carbon Steel, except that where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing an additional joint shall be provided. Joints shall be evenly spaced. Extruded aluminum gravel stops and fasciae shall have expansion joints at not more than 12-foot spacing.

3.6 FLASHINGS

Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof, and floor drains, and for electrical conduit projections through roof or walls is covered in appropriate sections for such work. Cap flashings shall be turned around exterior corners of masonry or concrete walls at least 2 inches, shall be secured into masonry joints and into concrete with expansion anchors and sealed with No. 2 or 4 sealing compound. Cap and base flashing for exterior and interior corners shall be factory-fabricated units. Corner units shall have mitered joints, shall be installed with 3-inch lap joint over flashings on each side. Except as otherwise indicated, cap flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement.

3.6.1 Base Flashing

Base flashing shall extend out on the roof or horizontal surface not less than 4 inches. Metal base flashing shall be installed at locations indicated and shall be coordinated with roofing work. Metal base flashing shall be set in plastic bituminous

cement over the roofing membrane, and nailed to nailing strip and shall be secured in place on the roof side with nails spaced not more than 3 inches on centers.

3.6.2 Cap Flashing

Cap flashing shall be installed either in a reglet specified in paragraph: REGLETS or shall consist of a two-piece combination unit with the receiver component built in the construction and the cap component interlocking not less than 1-1/2 inches into the receiver. The flange of the receiver component installed into masonry shall extend not less than 4 inches into the joint. Flange shall be located not less than 8 inches nor more than 16 inches above roofing not having cant strips or shall be located not less than 5 inches nor more than 13 inches above cant strip. Cap flashing shall overlap metal base flashing not less than 3 inches and when used with reglets shall extend into reglets not less than 1-1/8 inches. Cap flashing shall be factory formed to provide spring action against the base flashing. Lower edge shall have a longitudinal V-type crimp or shall be folded under not less than 1/2-inch. Cap flashing terminations shall be sealed.

3.6.3 Valley Flashing

Valley flashing shall be free from longitudinal seams and shall be of a width sufficient to extend not less than 5 inches under the roof covering on each side. The sheets shall lap not less than 8 inches in the direction of flow and shall be secured to roofing construction with cleats on each side. Cleats shall be spaced not more than 24 inches on centers. The exposed flashing shall be not less than 4 inches in width at the top and shall increase 1 inch in width for each additional 8 feet in length. Where the slope of the valley is 6 inches or less per foot, or the intersecting roofs are on different slopes, an inverted V-joint 1 inch high, shall be provided along the centerline of the valley, and the edge of the valley sheets shall extend 8 inches under the roof covering on each side.

3.7 GRAVEL STOPS AND FASCIA

Sheets shall be fabricated without longitudinal joints except where two-piece fasciae are used when fascia depth exceeds 7 inches. Provision for expansion shall be provided 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 roof not less than 4 inches, and shall be set in bituminous cement over the roofing felt. Roof flange shall be secured with nails spaced not greater than 3 inches on centers located within 1 inch of the outer edge of the flange. The fascia section shall not be face nailed except as specified for two-piece fasciae. The upper piece of two-piece fascia shall be the same as specified above except that the fascia depth shall be at least 3-1/2 inches, and it shall overlap the lower fascia not less than 2 inches. The lower piece shall be hooked 1/2 inch over edge strip and splice plate and face nailed on 12-inch centers 1 inch below top of sheet. The upper fascia shall be hemmed 1/2 inch at lower edge and shall be formed to fit tight against lower fascia. Either smooth or corrugated sheets may be used.

3.8 REGLETS

Reglets shall be a factory fabricated product of proven design, complete with fittings and special shapes as may be required. Open-type reglets shall be filled with fiberboard or other suitable separator to prevent crushing of the slot during installation. Reglets shall be located not less than 8 inches nor more than 16 inches above roofing not having cant strips or shall be located not less than 5 inches nor more than 13 inches above cant strip. Reglet plugs shall be spaced not over 12 inches on centers and reglet grooves 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 cap flashing together.

3.9 SCUPPER LININGS

The interior of scupper openings shall be lined with stainless steel sheet metal. The lining shall be formed to return not less than 1 inch against both faces of the wall or parapet with the outside edges folded under 1/2 inch less on the top and sides. The perimeter of the lining shall be approximately 1/2 inch less than the perimeter of the scupper. The top and sides of scuppers on the roof-deck side shall be joined to base flashing by a locked and soldered joint. The bottom edge shall be joined by a locked and soldered joint to the base flashing and where required, shall be formed with a ridge to act as a gravel stop around the scupper inlet. Surfaces to receive the lining shall be coated with bituminous cement.

3.10 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner at the Contractor's expense. 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 AND THICKNESSES

Item Description	Stainless steel inch	Carbon Steel Gauge
Building expansion joints:		
Cap	0.015	20 ga
Waterstop - bellows or flanged-U-type	0.015	20 ga
Cleats (Continuous)	0.025	24 ga
Covering on minor flat, pitched or curved surfaces	0.018	20 ga
Flashings:		
Base	0.018	24 ga
Cap, stepped or valley	0.015	24 ga
Gravel stops and fasciae:		
Sheets, smooth	0.018	24 ga
Scupper lining	0.015	24 ga
Reglets[1]	0.010	24 ga
Copings	0.015	20 ga

[1]May be polyvinyl chloride.

TABLE 2. FASTENER MATERIALS

To prevent corrosion, the indicated fastener materials shall be used with the following sheet metals:

Sheet Metal	Nails	Screws	Rivets	Bolts
Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel
Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel

TABLE 3. SHEET METAL JOINTS

Type of Joint

Item Designation	Stainless Steel Carbon 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 No. 7 sealant.
Cap-in reglet	3-inch lap.	Seal groove with No. 2 or 4 sealant.(a)
Cap - two-piece	Receiver 3-inch lap. Cap piece 3-inch lap.	-----
Through-wall spandrel flashing (metal)	1-1/2 inch mechanical interlock.	-----
Through-wall spandrel flashing (Coated or non-metal)	-----	3 inch lap with sealant
Valley	6-inch lap, cleated.	-----

TABLE 3. SHEET METAL JOINTS (Continued)

Item Designation	Type of Joint Stainless Steel Carbon Steel	Remarks
Gravel stops:		
Sheet, smooth	Butt with 1/4-inch space.	Use 6-inch cover plate.
Reglets	Butt joint.	Seal reglet groove with No. 2 or 4 sealant.(a)

(a) Polyvinyl chloride type reglet shall be sealed with manufacturer's recommended butyl rubber sealant.

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SECTION 07721

ROOF SKYLIGHTS

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 A 58.1	(1982) Minimum Design Loads for Buildings & Other Structures

1.2 DESIGN REQUIREMENTS

The skylights shall be of the stationary type, constructed of aluminum-alloy and the product of a manufacturer regularly engaged in the manufacture of roof skylights. The skylights shall be of the sizes indicated and shall be furnished complete with bases, and flashing flanges. The skylights shall be weatherproof. The design shall be such that the skylights will be capable of self-cleaning by the action of the elements with provision for carrying water and normal wind-transported soil matter to the outside. The skylights shall be designed for wind loads in accordance with ANSI A 58.1, but in no case shall the installed design be for less than 80 mph wind load. The structural bracing shall be properly spaced to accommodate this loading and in accordance with the design requirements of the covering material.

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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-04, Drawings

Roof Skylights; GA.

Drawings shall show location of each type of skylight with fully dimensioned drawings including the details of construction, gauges of metal, methods of operation, details and methods of anchorage and installation.

PART 2 PRODUCTS

2.1 FABRICATION

Skylights shall be adequately reinforced and well braced with joints properly formed. Edges shall be wired or beaded, where necessary, to insure rigidity. Galvanic action between different metals in direct contact shall be prevented by nonconductive separators. All soldering shall be even and smooth.

2.1.1 Bases

The base provided with the skylights shall be factory-formed of the type indicated and shall be of the same material as the hoods, and shall be of a thickness necessary to meet the design requirements specified herein. Bases shall be provided with flashing flanges extending over the adjoining roof surfaces a sufficient distance to provide for proper connection with the roof. Bases for skylights to be installed on built-up roofing shall be suitable for raised curb mounting. Curb flanges of the base shall be formed as cap flashing extending at least 4 inches over roofing base.

PART 3 EXECUTION

3.1 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:

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 INSTALLATION

Unless otherwise indicated, all equipment shall be installed in accordance with the manufacturer's recommendations. 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. Following installation, a Quality Inspection shall be performed and a report of inspection handed to the Contracting Officer.

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SECTION 07920

CAULKING AND SEALANTS

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 834	(1976; R 1986) Latex Ceiling Compounds

FEDERAL SPECIFICATIONS (FS)

FS TT-C-00598	(Rev C; Am 1) Calking Compound, Oil and Resin Base Type (for Building Construction)
FS TT-S-00227	(Rev E; Am 3) Sealing Compound, Elastomeric Type, Multi-Component for Calking, Sealing, and Glazing (for Buildings and Other Structures)
FS TT-S-00230	(Rev C; Am 2) Sealing Compound, Elastomeric Type, Single Component for Calking, Sealing, and Glazing (for Buildings and Other Structures)
FS TT-S-001657	(Basic) Sealing Compound, Single Component, Butyl Rubber Based, Solvent Release Type (for Buildings and Other Types of Construction)

1.2 GENERAL REQUIREMENTS

Caulking and sealants shall be provided in joints as indicated or specified. The joint design, shape, and spacing shall be as indicated. Mixing shall be in accordance with instructions provided by the manufacturer of the sealants.

1.3 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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-01, Data

Materials; GA.

Manufacturer's descriptive data for materials including backstop material, primer and sealer. Descriptive data for elastomeric sealants shall include shelf life, curing time, and mixing instructions for two component sealants.

1.3.2 SD-13, Certificates

Materials; F10.

Certificates of compliance stating that the caulking and sealants conform to the specified requirements. Certificates shall include laboratory test reports showing that the caulking and sealants have been tested within the last 12 months.

1.4 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 40 to 90 degrees F when the caulking and sealants are applied.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The containers shall include the following information on the label: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time when applicable at the standard conditions for laboratory tests. Caulking compound or components outdated as indicated by shelf life shall not be used. Materials shall be carefully handled and stored to prevent inclusion of foreign materials or exposure to temperatures exceeding 90 degrees F. Sealant tape shall be handled and stored in a manner that will not deform the tape.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the respective specifications and other requirements specified. Each container brought to the jobsite with a different sealant formulation shall be marked for the intended use. For each intended use the Contracting Officer shall select the manufacturer's standard color most compatible with the adjacent materials.

2.1.1 No. 1 Caulking Compound

No. 1 caulking compound shall conform to FS TT-C-00598, Type I.

2.1.2 No. 2 Sealant

No. 2 sealant shall be a two-component, elastomeric-type compound conforming to FS TT-S-00227, Type II, Class A. The compound shall be supplied in pre-measured kit form for on-the-job mixing.

2.1.3 No. 3 Sealant

No. 3 sealant shall be a single-component conforming to FS TT-S-001657, Type I or II.

2.1.4 No. 4 Sealant

No. 4 sealant shall be a one-component, elastomeric-type compound conforming to FS TT-S-00230, Type II, Class A.

2.1.5 No. 6 Sealant

No. 6 sealant shall be a one-component latex sealing compound conforming to ASTM C 834.

2.2 PRIMER

Primer for No. 2, 3 and 4 sealant shall be as recommended by the sealant manufacturer. Primer shall have been tested for durability with the sealant to be used and on samples of the surfaces to be sealed.

2.3 BACKSTOP MATERIAL

Backstop materials shall be resilient urethane or polyvinyl chloride foam, closed-cell polyethylene foam, closed-cell sponge of vinyl or rubber, polychloroprene tubes or beads, polyisobutylene extrusions, oilless dry jute, or rope yarn. Backstop material shall be nonabsorbent, nonstaining, and compatible with the sealant used. Tube or rod stock shall be rolled into the joint cavity. Preformed support strips for ceramic and quarry tile control-joint and expansion-joint work shall be polyisobutylene or polychloroprene rubber.

2.4 BOND-PREVENTIVE MATERIALS

Bond-preventive materials shall be pressure-sensitive adhesive polyethylene tape, aluminum foil or wax paper. At the option of the Contractor, backstop material with bond breaking characteristics may be installed in lieu of bond-preventive materials specified.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 General

The surfaces of joints to be sealed shall be dry. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from all joint surfaces to be sealed. Oil and grease shall be removed with solvent and surfaces shall be wiped with clean cloths.

3.1.2 Concrete 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.

3.2 SEALANT USES

The sealant(s) to be used in the various joints shall be indicated in the drawings or chosen by the Contractor, who shall base the decision on the manufacturer's recommendations and location of the seal or caulk.

3.3 APPLICATION

3.3.1 Paper Masking Tape

Paper 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 compound smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

3.3.2 Bond-Preventive Materials

Bond-preventive materials for sealant shall be installed on the bottom of the joint cavity and other surfaces indicated to prevent the sealant from adhering to the surfaces covered by the bond-preventive materials. The materials shall be carefully applied to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond-preventive materials.

3.3.3 Backstops

The back or bottom of joints constructed deeper than indicated shall be packed tightly with backstop material to provide a joint of the depth indicated. Where necessary to provide a backstop for caulking compound, the joint shall be packed tightly with rope yarn.

3.3.4 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 receive primer.

3.3.5 No. 1 Caulking Compound

Compound shall be gun-applied with a nozzle of proper size to fit the width of joint indicated and shall be forced into grooves with sufficient pressure to expel air and fill the groove solidly. Caulking shall be uniformly smooth and free of wrinkles and shall be left sufficiently convex to result in a flush joint when dry. One coat of sealer shall be applied over joint after compound has dried sufficiently to develop a surface skin so as not to deform the surface of the joint.

3.3.6 Sealant

Sealant shall be gun-applied with a nozzle of proper size to fit the width of joint indicated and shall be forced into grooves with sufficient pressure to expel air and fill the groove solidly. Sealant shall be uniformly smooth and free of wrinkles. Joints shall be tooled slightly concave after sealant is installed. When tooling light-color sealant, dry or water-wet tool shall be used.

3.4 CLEANING

The surfaces adjoining the caulked and sealed joints shall be cleaned of smears and other soiling resulting from the caulking and sealing application as work progresses.

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SECTION 08110

STEEL DOORS AND FRAMES

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

DOOR AND HARDWARE INSTITUTE (DHI)

DHI-02	(1986) Installation Guide for Doors and Hardware

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1990) Fire Doors and Windows
NFPA 80A	(1987) Protection of Buildings from Exterior Fire Exposures
NFPA 101	(1991) Safety to Life from Fire in Buildings and Structures

STEEL DOOR INSTITUTE (SDOI)

SDOI SDI 100	(1991) Standard Steel Doors and Frames
SDOI SDI 106	(1991) 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: SUBMITTAL DESCRIPTIONS.

1.2.1 SD-04, Drawings

Doors and Frames; GA.

Drawings shall use standard door type nomenclature in accordance with SDOI SDI 106 and shall indicate 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 struts and anchors for frames, and thicknesses of metal. Drawings shall include catalog cuts or descriptive data for the weatherstripping including air infiltration data.

1.3 DELIVERY AND STORAGE

To provide protection during shipment, welded unit type frames shall be strapped together in pairs with heads at opposite ends or 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 good air circulation. Doors and assembled frames shall be stored in an upright position. Whenever damage becomes evident, abraded, scarred, or rusty areas shall be cleaned and touched up with the paint used for the shop painting.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Doors and frames shall be shop fabricated conforming to SDOI 100 and the additional requirements specified herein. Door grade shall be heavy duty unless otherwise indicated on the door and door frame schedules. Exterior doors and frames shall be steel. Doors and frames shall be prepared to receive hardware conforming to the templates and information provided under SECTION: HARDWARE; BUILDERS' (GENERAL PURPOSE). Rubber silencers shall be installed 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 glazed doors shall conform to SDOI 100, Style 5, and include provisions for glazing. The Contractor shall coordinate between the hardware and door suppliers to assure that reinforcing of door assemblies for closers and other required hardware shall conform to SDOI 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.

2.1.1 Weatherstripping

Unless otherwise specified in SECTION: HARDWARE; BUILDERS' (GENERAL PURPOSE), weatherstripping shall be as specified below. Weatherstripping for head and jamb shall be manufacturers 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 cubic feet per minute per linear foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall conform to DHI-02, The Installation of Custom Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames, and Builders Hardware. Steel doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, flush bolts, and closers as required. Preparation for hardware shall be in accordance with SDOI 107. Weatherstripping shall be installed at exterior door openings to provide a weathertight installation. Installation and operational characteristics of fire doors shall conform to NFPA 80, NFPA 80A and NFPA 101.

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SECTION 08201

WOOD DOORS

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.

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI-02	(5th Ed) Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1990) Fire Doors and Windows
NFPA 101	(1991) Safety to Life from Fire in Buildings and Structures

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

NWWDA I.S. 1	(1987) Wood Flush Doors

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Doors shall be of the type, size, and design indicated on the drawings, and shall be the standard products of manufacturers regularly engaged in the manufacture of wood doors.

1.2.2 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door. The identifying mark or a separate certification shall include identification of the standard on which construction of the door is based, identity of the manufacturing plant, identification of the standard under which preservative treatment, if used, was made, and identification of the doors having a Type I glue bond.

1.3 SUBMITTALS

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

1.3.1 SD-04, Drawings

Wood Doors and Frames; GA.

Drawings indicating the location of each door, elevation of each type of door, details of construction, marks to be used to identify the doors, and location and extent of hardware blocking. Drawings shall include catalog cuts or descriptive data for weatherstripping and thresholds to be used.

1.3.2 SD-13, Certificates

Fire Rated Doors; GA.

Certificates for oversize fire doors shall state that the doors are identical in design, materials, and construction to a door that has been tested and meets the requirements for the class indicated. Certificates certifying the fire-rating for 20- and 30-minute fire doors conform to the standards specified.

1.3.3 SD-14, Samples

Veneer Sample; GA. Factory Coated Natural Finish; GA.

Samples of factory applied natural finish and unform white birch veneer shall be provided.

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: BUILDERS' HARDWARE (GENERAL PURPOSE).

PART 2 PRODUCTS

2.1 GENERAL FABRICATION REQUIREMENTS

2.1.1 Edge Sealing

All wood end-grain exposed at edges of doors shall be sealed prior to shipment.

2.1.2 Adhesives

Adhesives shall be in accordance with NWWDA I.S. 1, using requirements for Type I Bond Doors for exterior doors and requirements for Type II Bond Doors for interior doors. Adhesive for doors to receive a transparent finish shall be nonstaining.

2.1.3 Prefitting

Doors shall be furnished prefitted or unfitted at the option of the Contractor, except plastic laminate clad doors shall be furnished prefit in accordance with the standards under which they are produced.

2.2 FLUSH DOORS

Flush doors shall be solid core as shown on the drawings, and shall conform to NWWDA I.S. 1, except for the one year acclimazation requirement in section IS 1.1, paragraph 3.5.3.1, which shall not apply. Wood doors shall be 5-ply or 7-ply construction with faces, stiles, and rails bonded to the cores.

2.2.1 Core Construction

2.2.1.1 Solid Cores

Where not otherwise required by fire rating, construction shall be glued block core with stiles and rails bonded to the core.

2.2.2 Face Panels

2.2.2.1 Natural Finished Doors

Doors to receive natural finish shall be of Select Grade with uniform white birch veneer in accordance with NWWDA I.S. 1. Vertical stile strips shall be selected to provide edges of the same species and/or color as the face veneer.

2.3 FIRE RATED DOORS

Fire rated doors shall be provided at locations shown on the drawings. Except for 20 and 30 minute rated fire doors, which shall be solid wood core installed as specified in NFPA 80 for Class "C" door assemblies, fire doors shall bear the identifying label of Underwriters Laboratories.

2.3.1 Hardware Blocking

Composite fire rated doors shall be provided with hardware reinforcement blocking, including lock blocks and top, bottom, and intermediate rail blocking. Lock blocks shall be not less than 5 inches by 18 inches. Rail blocks shall be not less than 5 inches wide by full core thickness. All reinforcement blocking shall be in compliance with the manufacturer's labeling requirements. Reinforcement blocking shall not be of mineral material similar to the core.

2.3.2 Stile Edges

Composite fire rated doors shall be provided with vertical stile edges that do not contain fire retardant salts. Vertical stiles shall be of the same species and/or color as the face veneer. Stiles shall be SLM type.

2.3.3 Wood Block Cores

Twenty- and thirty-minute fire rated doors shall have glued wood block (staved lumber) cores with faces, stiles, and rails bonded to the core.

2.4 FINISHING

2.4.1 Field Finishing

Doors to receive field finishing, natural finish, shall be factory sealed and then finished in accordance with SECTION: PAINTING, GENERAL.

2.4.2 Factory Coated Natural Finish

Doors indicated to receive factory coated natural finish shall be given a transparent finish conforming to AWI-02, Test 1500, Custom Grade, medium rubbed sheen, close grain effect. Finish shall be AWI factory finish system Number 3 or 4. The natural finish shall be as indicated on the Room Finish. Edges of unfitted doors shall be field finished after fitting to the frames.

2.5 WOOD FRAMES

Wood frames shall be provided where shown on the drawings. For interior frames, applied stops are permitted unless otherwise indicated.

PART 3 EXECUTION

3.1 INSTALLATION OF DOORS

3.1.1 Installation of Doors

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 of 1/4-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.

3.1.2 Installation of Fire Doors

Installation, hardware, and operational characteristics shall conform to NFPA 80 and NFPA 101 and shall be in strict conformance with the manufacturer's printed instructions. Properly sized pilot holes shall be drilled for screws in door edges. Factory applied labels shall remain intact where installed. Labeled hinge stile edge and top edge of door shall not be trimmed. Lockstile edge and bottom edge may be trimmed only to the extent recommended by the door manufacturer.

3.2 INSTALLATION OF WOOD FRAMES

Frames shall be set plumb and square, and rigidly anchored in place using finish type nails. Double wedge blocking shall be provided near the top, bottom, and mid-point of each jamb.

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SECTION 08312

SLIDING DOORS

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

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
NEMA MG 1	(1987; Rev 1) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1990) National Electrical Code
NFPA 80	(1990) Fire Doors and Windows

UNDERWRITERS LABORATORIES (UL)

UL 14B	(1979; Rev thru Oct 1984) Sliding Hardware for Standard, Horizontally Mounted Tin-Clad Fire Doors

1.2 GENERAL

Doors shall conform to NFPA 80 and the requirements specified herein. Fire rating for doors shall be as shown on the drawings. Each door shall be complete with operating devices, hardware, and accessories. Each door shall be provided with a permanent nameplate showing the manufacturer's name, address, and the model number of the door.

1.2.1 Design Requirements

Minimum design wind load shall be 70 pounds per square foot. Doors shall be constructed to sustain a superimposed load, both inward and outward, equal to 1-1/2 times the minimum design wind load. When tested in accordance with the static air

pressure test procedure of ASTM E 330, 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. As an option, tests shall be conducted using an equivalent uniform static load. The uniform static load test specimen shall be supported using rollers and track as required for project installation. Recovery shall be at least three-fourths of the maximum deflection within 24 hours after the test load is removed.

1.3 SUBMITTALS

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

1.3.1 SD-04, Drawings

Sliding Glass Doors; GA.

A schedule showing the location of each door shall be included with the drawings. 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 tracks, rollers, power operators, controls, and other fittings. Manufacturer's catalog and warranty data shall be included.

1.3.2 SD-19, Operation and Maintenance Manuals

Sliding Glass Doors; F10.

Manufacturer's installation, operation, and maintenance instructions.

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 an adequately ventilated, dry location that is free from dust, water, or other contaminants and in a manner that permits access for inspection and handling. Doors shall be handled carefully to prevent damage to the faces, edges, and ends. Damaged items that cannot be restored to like-new condition shall be replaced at the Contractor's expense.

PART 2 PRODUCTS

2.1 SLIDING DOORS

Sliding doors shall be of the following types:

2.1.1 Glass Doors

The door leaves shall be constructed of 1/2" thick tempered clear glass. The top rail of the doors shall be 1-3/4" x 4-1/4" and the bottom rails shall be 1-3/4" x 4-1/2". No vertical rails will be allowed. The side panels shall not have rails. The doors and panels shall be supported by a structural header fully incorporating the automatic door operator. The header shall be 1/4" wall extruded steel and shall self-support

the shop-front in lengths up to 16 feet without any additional center supporting tie bolt. The header shall have an access panel of 3/16" extruded aluminum. The top and bottom rail shall be stainless steel. The doors and frames shall be true and square with all panels vertical and sliding in the same plane.

2.2 OPERATION

Doors shall be single-slide on level tracks and shall be designed to normally remain in the closed position but permit normal operation for passage. Doors shall be power operated. Automatic closing system shall be as indicated below.

2.2.1 Power Operators for Automatic Door System for Main Entry

Automatic door system header, operator, hyperwave actuation device and safety beam feature. System to be complete with all parts and accessories necessary for a complete installation in accordance with the drawings. Automatic door system header as supplied shall have a panic break away feature meeting the requirements of all applicable codes to function as an approved emergency exit. Supply standard 5 year guarantee on sliding door assembly with standard 2 year guarantee on doors, frames and actuation equipment.

2.2.2 Safety Device

The leading edge of doors shall have a safety device that will immediately reverse the door movement upon contact with an obstruction and cause the door to return to its full open position. The safety device shall not substitute for a limit switch. Exterior doors shall be provided with a combination weather seal and safety device.

2.2.3 Electric Operators

The operator shall be heavy-duty industrial type designed to operate the door at not less than two-thirds or more than 1 foot per second. Electrical controls shall be push button wall switches as indicated. Electric power operators shall be complete with electric motor, brackets, controls, limit switches, magnetic reversing starter, and all other accessories necessary. The operator shall be so designed that the motor may be removed without disturbing the limit-switch timing and without affecting the emergency operator. The power operator shall be provided with a slipping clutch coupling to prevent stalling of the motor. Operators shall have provisions for immediate emergency manual operation of the door in case of electrical failure. Where control voltages differ from motor voltage, a control voltage transformer shall be provided in and as part of the starter. Control voltage shall be 120 volts or less.

2.2.3.1 Motors

Drive motors shall conform to NEMA MG 1, shall be high-starting torque, reversible type, and shall be of sufficient horsepower and torque output to move the door in either direction from any position at the required speed without exceeding the rated capacity. Motors shall be suitable for operation on available power source. All motors shall be designed to operate at full capacity over a supply voltage variation of plus or minus 10 percent of the motor voltage rating.

2.2.3.2 Controls

Each door motor shall have an enclosed reversing across-the-line type magnetic starter having thermal overload protection, limit switches, and remote-control switches. The control equipment shall conform to NEMA ICS 2; enclosures shall be NEMA ICS 6 Type 12 (industrial use), or as otherwise indicated. Each wall control station shall be of the three-button type, with the controls marked "OPEN," "CLOSE," and "STOP." When the door is in motion and the "STOP" control is pressed, the door shall stop instantly and remain in the stop position; from the stop position, the door shall be operable in either direction by the "OPEN" or "CLOSE" controls. Controls shall be of the full-guarded type to prevent accidental operation.

2.2.4 Electrical Work

All conduit and wiring necessary for proper operation shall be provided in accordance with SECTION: ELECTRICAL WORK, INTERIOR. Flexible connections between doors and fixed supports shall be made with extra flexible type SO cable, except in hazardous locations where wiring shall conform to NFPA 70. The cable shall have spring-loaded automatic take-up reel or an equivalent and approved device.

2.3 HARDWARE

Hardware shall conform to NFPA 80, UL 14B and the requirements specified herein. Tracks, roller assemblies, and installation hardware shall be designed to support a dead load equal to 1-1/2 times the weight of the door and attached hardware without deformation that would interfere with the operation of the door. Tracks shall be formed of steel not lighter than 14 gauge. Ball or roller bearing wheels or rollers with case hardened races shall be provided on all devices incorporating wheels or rollers. Hardware shall be attached using through bolts, nut plates, or similar devices to ensure adequate fastener strength. Recessed steel pulls shall be provided on both sides of all door leaves.

2.4 ACCESSORIES

2.4.1 Track Hood

Track hood for exterior doors mounted on the exterior face of the wall shall be zinc-coated steel not lighter than 18 gauge.

2.4.2 Weatherstripping

Weatherstripping shall be provided on head, jamb, and sills of exterior doors. Weatherstripping shall be 1/16-inch thick fabric-reinforced neoprene or shall be nylon-brush type, and shall be installed using continuous metal retainers.

2.4.3 Locking Device

Locks shall conform to Hardware Set no HW1 on Hardware Schedule in SECTION: BUILDERS' HARDWARE.

PART 3 EXECUTION

3.1 INSTALLATION

Doors shall be installed in accordance with NFPA 80, approved detail drawings and

manufacturer's instructions. Anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories shall be accurately located. Upon completion, doors shall be free from warp, twist, or distortion. Exterior doors shall be weather tight. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

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SECTION 08330

OVERHEAD COILING DOORS

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 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 525	(1991b) General Requirement for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM E 330	(1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

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
NEMA MG 1	(1987; Rev 1) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1990) National Electrical Code
NFPA 80	(1990) Fire Doors and Windows

1.2 GENERAL REQUIREMENTS

Doors shall be spring counterbalanced, overhead coiling type, and shall be designed for use on exterior openings as indicated. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model number of the door.

1.3 DESIGN

The door and the operating mechanism shall be designed to meet the requirements described herein. The manufacturer's data sheets shall clearly state that the door and operator have been designed to meet these requirements or the submittal is to include a manufacturer's statement, signed by an official of the company, certifying that the door and operator have been designed to meet the specified requirements.

1.3.1 Wind Load Requirements

Doors and components shall be designed to withstand the minimum design wind load of 70 pounds per square foot. Doors shall be constructed to sustain a superimposed load, both inward and outward, equal to 1-1/2 times the minimum design wind load. When tested in accordance with the static air pressure test procedures of ASTM E 330, 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. As an option, tests shall be conducted using an equivalent uniform static load. The uniform static load test specimen shall be supported using guides, endlocks, and windlocks as required for project installation. Recovery shall be at least 3/4 of the maximum deflection within 24 hours after the test load is removed.

1.3.2 Door Operating Mechanism

All portions of the door operating mechanism that are subject to movement wear or stress fatigue are to be designed to operate through a minimum of 100,000 cycles. One complete cycle of door operation will begin with the door in the closed position, move to the full open position and return to the closed position.

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: SUBMITTAL DESCRIPTIONS.

1.4.1 SD-01, Data

Overhead Coiling Door Unit; GA.

Manufacturer's catalog data and warranty.

1.4.2 SD-04, Drawings

Overhead Coiling Door Unit; GA.

A schedule showing the location of each door shall be included with the drawings. 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.

1.4.3 SD-06, Instructions

Overhead Coiling Door Unit; GA.

Manufacturer's preprinted installation instructions.

1.4.4 SD-13, Certificates

Fire Doors; GA.

Certificates for oversize fire doors shall state 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.

1.4.5 SD-19, Operation and Maintenance Manuals

Overhead Coiling Door Unit; GA.

Six complete copies of operating instructions outlining the step-by-step procedures required for motorized door and shutter operation. 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 complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed. Also spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 year(s) of service.

1.5 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. Doors shall be handled carefully to prevent damage. Damaged items that cannot be restored to like-new condition shall be replaced.

PART 2 PRODUCTS

2.1 OVERHEAD COILING DOOR UNIT

Doors shall be complete with guides, fastenings, hood, counterbalance, brackets, operating mechanisms, and accessories. Doors shall be surface-mounted type with guides at jambs set back a sufficient distance to clear the opening. Exterior doors shall be mounted as indicated.

2.1.1 Curtains

Curtains shall be formed of interlocking galvanized steel slats of shapes standard with the manufacturer. Slats for exterior doors shall be flat type. The curtains shall roll up on a barrel supported at the head of opening on brackets, and shall be balanced by helical springs. Slats for doors less than 15 feet wide shall be not

lighter than 22 gauge. Slats for doors from 15 feet wide to 21 feet wide shall be not lighter than 20 gauge. Slats for doors 21 feet wide and wider shall be not lighter than 18 gauge.

2.1.2 Endlocks

The ends of each slat for exterior doors shall have malleable endlocks of manufacturer's stock design.

2.1.3 Bottom Bar

The curtain shall have a bottom bar consisting of two steel angles. A safety device shall be attached to the bottom bar of doors that are electric-power operated.

2.1.4 Guides

Guides shall be steel structural shapes or formed steel shapes, not less than 2-1/2 inches deep and not less than 3/16-inch thick. Guides shall be attached to adjoining construction with not less than 3/8-inch diameter bolts, spaced near each end and not over 24 inches apart for interior doors and 16 inches apart for exterior doors.

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 cast-iron or steel plugs, machined to fit the pipe.

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 heavy cast-iron or steel to close the ends of the roller-shaft housing, and to form a supporting ring for the hood. Bracket hubs or shaft plugs shall have sealed prelubricated ball bearings.

2.1.8 Hoods

Hoods shall be stainless steel, not lighter than 24 gauge, formed to fit contour of the end brackets, and shall be reinforced with steel rods or rolled beads at top and bottom edges.

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, or shall be nylon-brush type.

A weather baffle shall be provided at the lintel or inside the hood. Weatherstripping shall be easily replaced without special tools.

2.2 OPERATION

Doors shall be electric power with auxiliary chain hoist operated.

2.2.1 Electric Power With Auxiliary Chain Hoist Operation

Electric power operators shall be heavy-duty industrial type. Acceptable evidence shall be furnished to demonstrate that the unit will operate the door through minimum number of specified cycles. The electric power operator shall be complete with electric motor, reduction gears, magnetic brake, brackets, push button controls, limit switches, magnetic reversing starter, and all other accessories necessary. The operator shall be so designed that the motor may be removed without disturbing the limit-switch timing and without affecting the emergency chain operator. The power operator shall be provided with a slipping clutch coupling to prevent stalling of the motor. Doors shall be provided with an auxiliary operator for immediate emergency manual operation of the door in case of electrical failure. The emergency manual operating mechanism shall be so arranged that it may be operated from the floor without affecting the timing of the limit switches. A mechanical device shall be included that will disconnect the motor from the drive operating mechanism when the auxiliary operator is used. Where control voltages differ from motor voltage, a control voltage transformer shall be provided in and as part of the starter. Control voltage shall be 120 volts or less.

2.2.1.1 Motors

Drive motors shall conform to NEMA MG 1, shall be high-starting torque, reversible type, and shall be of sufficient horsepower and torque output to move the door in either direction from any position at a speed of not less than 3/4 foot per second without exceeding the rated capacity. Motors shall be suitable for available power source. All motors shall be designed to operate at full capacity over a supply voltage variation of plus or minus 10 percent of the motor voltage rating.

2.2.1.2 Controls

Each door motor shall have an enclosed reversing across-the-line type magnetic starter having thermal overload protection, solenoid operated brake, limit switches, and remote control stations. The control equipment shall conform to NEMA ICS 2. Enclosures shall conform to NEMA ICS 6, Type 12 (industrial use), Type 7 or 9 in hazardous locations, or as otherwise indicated. Exterior control stations shall be weatherproof key-operated type with corrosion-resistant cast-metal cover. Each control station shall be of the three-button or switch type, with the controls marked "OPEN," "CLOSE," and "STOP." The "OPEN" and "STOP" controls shall be of the momentary contact type with seal-in contact. The "CLOSE" control shall be of the momentary contact type. When the door is in motion and the "STOP" control is pressed, the door shall stop instantly and remain in the stop position; from the stop position, the door shall be operable in either direction by the "OPEN" or "CLOSE" controls. Controls shall be of the full-guarded type to prevent accidental operation. Readily adjustable limit switches shall be provided to automatically stop the doors at their fully open and closed positions.

2.2.1.3 Safety Device

The bottom edge of doors shall have a safety device that will immediately reverse the door movement upon contact with an obstruction and cause the door to return to its full open position. The safety device shall not substitute for a limit switch. Exterior doors shall be provided with a combination compressible weather seal and safety device. Also, the doors shall have a safety device that prevents the door curtain from free-falling in the event of damage to the drive chain, motor operator, pipe shaft, or counter-balancing springs.

2.2.1.4 Electrical Work

All conduit and wiring necessary for proper operation shall be provided in accordance with SECTION: ELECTRICAL WORK, INTERIOR. Flexible connections between doors and fixed supports shall be made with extra flexible type SO cable, except in hazardous locations where wiring shall conform to NFPA 70, Article 501 or 502 as appropriate. The cable shall have a spring-loaded automatic take up reel or an equivalent and approved device.

2.3 FINISH

Slats, bottom bars, and hoods of exterior doors shall be hot-dip galvanized and shop primed. Other parts of coiling doors, except faying surfaces, shall be shop-primed.

2.3.1 Primed Finish

Surfaces shall be thoroughly cleaned and treated to assure maximum paint adherence. Exposed surfaces shall be given a factory dip or spray coat of rust-inhibitive metallic oxide or synthetic resin primer.

2.3.2 Galvanized and Shop-Primed Finish

Surfaces shall have a zinc coating, a phosphate treatment, and a shop-prime coat of rust-inhibitive paint. The galvanized coating shall conform to ASTM A 525, coating designation G90 for steel sheets, and to ASTM A 123 for assembled steel products. The prime coat shall be a type especially developed for materials treated by phosphates and adapted to application by dipping or spraying. Damaged zinc-coated surfaces shall be repaired by the application of galvanizing repair paint and spot primed.

2.4 FIRE DOORS

Coiling steel fire doors shall conform to the requirements specified herein and to NFPA 80 for the class indicated. Doors shall bear Underwriter's Laboratories or Factory Mutual labels indicating the applicable fire rating. The construction details necessary for labeled doors shall take precedence over details indicated or specified herein. Fire doors shall be complete with hardware, accessories, and automatic closing device.

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, motors, switches, hardware, and other accessories shall be accurately located. Upon completion, doors shall be weathertight and shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely. Fire doors shall be installed in conformance with the requirements of NFPA 80 and the manufacturer's instructions.

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SECTION 08700

BUILDERS' HARDWARE

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 A115.1	(1971) Door and Frame Preparation for Hardware
ANSI A117.1	(1986) Building and Facilities - Providing Accessibility and Usability for Physically Handicapped People

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 1991) Directory of Certified Locks & Latches
BHMA-02	(Effective thru Jul 1991) Directory of Certified Door Closers
BHMA A156.1	(1988) Butts and Hinges
BHMA A156.3	(1989) Exit Devices
BHMA A156.4	(1986) Door Controls - Closers
BHMA A156.5	(1984) Auxiliary Locks & Associated Products
BHMA A156.7	(1988) Template Hinge Dimensions
BHMA A156.8	(1988) Door Controls - Overhead Holders
BHMA A156.13	(1987) Mortise Locks & Latches
BHMA A156.16	(1989) Auxiliary Hardware

BHMA A156.18	(1987) Materials and Finishes
BHMA A156.21	(1989) Thresholds

DOOR AND HARDWARE INSTITUTE (DHI)

DHI-02	(1986) Installation Guide for Doors and Hardware
DHI-03	(1989) Keying Systems and Nomenclature
DHI-04	(1976) Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames
DHI-05	(1990) Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames
DHI A115-W	(1988) Wood Door Hardware Standards - Complete Set (Incl A115-W1 thru A115-W9)

FEDERAL SPECIFICATIONS (FS)

FS FF-H-106	(Rev C) Hardward, Builders Locks and Door Trim

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1990) Fire Doors and Windows

1.2 SUBMITTALS

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

1.2.1 SD-01, Data

Hardware and Accessories; GA.

Manufacturer's descriptive data, technical literature, catalog cuts, warranties, 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.

1.2.2 SD-04, Drawings

Hardware Devices; GA.

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

1.2.3 SD-07, Schedules

Hardware Schedule; GA.

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

Keying Schedule; GA.

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

1.2.4 SD-13, Certificates

Hardware and Accessories; GA.

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

1.2.5 SD-19, Operation and Maintenance Manuals

Hardware and Accessories; GA.

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

1.3 DELIVERY, STORAGE, AND HANDLING

Hardware shall be delivered to the project site in the manufacturer's original packages. Each article of hardware shall be individually packaged in the manufacturer's standard commercial carton or container, and shall be properly marked or labeled to be readily identifiable with the approved hardware schedule. Each

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

1.4 SPECIAL TOOLS

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

PART 2 PRODUCTS

2.1 GENERAL HARDWARE REQUIREMENTS

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Hardware set numbers correspond to the set numbers shown on the drawings. Hardware items providing accessibility and usability for physically handicapped shall comply with ANSI A117.1.

2.2 TEMPLATES

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

2.3 HINGES

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

2.3.1 Hinges for Reverse Bevel Doors with Locks

Hinges for reverse bevel doors with locks shall have pins that are made nonremovable by means such as a set screw in the barrel, or safety stud, when the door is in the closed position.

2.3.2 Contractor's Option

Hinges with antifriction bearings may be furnished in lieu of ball bearing hinges, except where prohibited for fire doors by the requirements of NFPA 80.

2.3.3 Pivot Hinges

Pivot hinges shall conform to BHMA A156.4.

2.4 LOCKS AND LATCHES

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

wrought boxes. Lock and latch set trim (knobs, handles, roses and escutcheons) shall be of a simple design in accordance with manufacturer's standard practice. Knob diameter shall be 2-1/8 to 2-1/4 inches.

2.4.1 Mortise Lock and Latchsets

Mortise lock, latchsets, and strikes shall be equivalent to Modric 1500 series locks and cylinders and shall conform to BHMA A156.13 Grudel, FS FF-H-106 series 86 and uses an ANSI A115.1 preparation. 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 Lock Cylinders (Mortise, Rim and Bored)

Lock cylinders shall comply with BHMA A156.5. Lock cylinder shall have not less than six pins. Cylinders shall have key removable type cores. A grand master keying system shall be provided. A construction master keying system and 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.

2.4.3 Lock Trim

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. Lock trim must meet the test requirement of BS5750 quality assurance system.

2.4.4 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 will be cut to suit cylinders and operating trim.

2.5 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:	2 change keys each lock.
Master keyed sets:	4 keys each set.
Grand master keys:	4 total.
Construction keys:	4 total.
Blank keys:	8 total.

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

2.6 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.

2.6.1 Surface Type Closers

Surface type closers shall be Grade 1, Series C01000 with options PT-4C and PT-4D with options PT-4H, Size 1 or 2 through Size 6, and PT-4D with back check position valve. Except as otherwise specified, sizes shall conform to the manufacturer's published recommendations. Closers for outswinging exterior doors shall have parallel arms or shall be top jamb mounted. Closers for doors close to a wall shall be of narrow projection so as not to strike the wall at the 90-degree open position.

2.6.2 Floor Closers and Pivots

Floor closers shall be Grade 1 with internal dead stop for all exterior doors. Floor closers shall have cement boxes. Pivots used on doors with floor closers shall be of the same manufacturer as the floor closers. Floor plates are not required where thresholds cover the closer cement box. Floor closers shall have independent latch and sweep speed adjusting valves, backcheck, mechanical selective hold-open (except fire rated openings), and optional delayed action. Setting tools shall be furnished for use in installing floor closers. Electric pivots and floor closers shall comply with BHMA A156.4 with modifications to ensure correct operation of electric hardware items.

2.7 AUXILIARY HARDWARE

Auxiliary hardware, consisting of door holders, door stops, and roller latches, shall conform to BHMA A156.16. Lever extension flush bolts shall be Type L14081.

2.8 MISCELLANEOUS

2.8.1 Metal Thresholds

Thresholds shall conform to BHMA A156.21. Thresholds for exterior doors shall be stainless steel 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. Latching thresholds shall conform to BHMA A156.3, Type 26, and of such height that the bottom of the door shall be 1/8 inch over the tread of the threshold and 1/8 inch below the top of the stop. Where required, thresholds shall be modified to receive projecting bolts of flush bolts and exit devices. Thresholds for doors 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.

2.8.2 Aluminum Housed Type Weatherseals

Weatherseals of the type indicated shall consist of extruded aluminum retainers not less than 0.07 inch wall thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be anodized. Weatherseal material shall be of an industrial/commercial grade. Seals shall remain functional through all weather

and temperature conditions. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.9 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. Hex 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.

2.10 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: PAINTING, GENERAL.

PART 3 EXECUTION

3.1 APPLICATION

Hardware shall be located in accordance with DHI-04 and DHI-05. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI-02 or DHI A115-W. Door control devices for exterior doors such as closers and holders, shall normally attach to doors with thru bolts and nuts or hex bolts. Electric hardware items and access control devices shall be installed in accordance with manufacturer's printed installation procedures.

3.1.1 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.

3.1.2 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.

3.1.3 Thresholds

Exterior thresholds shall be installed in a bed of sealant with stainless steel screws and expansion shields. Minimum screw size shall be No. 10, length dependent on job conditions.

3.1.4 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 HARDWARE SETS

HW1	
2 ea.	double cylinder dead bolt lock series 4,000
HW2	
1-1/2 pr.	hinges
1 ea.	lockset
3 ea.	rubber door silencers
1 ea.	stop
HW 3	
3 pr.	hinges
1 ea.	lockset
6 ea.	rubber door silencers
2 ea.	stop
1 ea.	meeting stiles
HW4	
1 ea.	pivot/closer
1 ea.	cylinder dead bolt lock
1 pr.	push and pull bars J500 16" long
1 ea.	kick plate J100
HW5	
1 ea.	pivot/closer
1 ea.	stop
1 ea.	push and pull bars J500 12" long
HW6	
1 ea.	sliding door
1 ea.	door stop
1 pr.	push and pull bars J500
HW7	
1-1/2 pr.	hinges
1 ea.	lockset
6 ea.	rubber door silencer
2 ea.	stops
1 ea.	kick plate J100
1 ea.	over head holder BHMA A156.8
HW8	
4 pr.	hinges
1 ea.	padlock

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DOORS AND WINDOWS

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SECTION 08810

GLASS AND GLAZING

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
ASTM C 1048	(1991) Heat-Treated Flat Glass-King HS, Kind FT Coated and Uncoated Glass

FEDERAL SPECIFICATIONS (FS)

FS DD-M-00411	(Rev C) Mirrors, Glass

FLAT GLASS MARKETING ASSOCIATION (FGMA)

FGMA-01	(1990) Glazing Manual

1.2 GENERAL

Glass shall be provided in the locations indicated. Glazing may be performed in the shop or in the field using glass of the quality and thickness specified or 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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-01, Data

Glass; GA. Setting Materials; GA.

Manufacturer's descriptive product data, handling and storage recommendations, and installation instructions.

1.3.2 SD-04, Drawings

Glazing Materials and Accessories; GA.

Drawings showing complete details of the proposed setting methods and materials.

1.3.3 SD-13, Certificates

Glass; GA.

Certificates shall state that the glass meets the specified requirements. Labels or marking affixed to the glass will be accepted in lieu of certificates.

1.4 DELIVERY AND STORAGE

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 and shall not be unpacked until needed for installation. Glass delivery scheduling shall be such as to not require onsite storage over 1 month.

1.5 GUARANTEE

Insulating glass units shall be guaranteed not to develop material obstruction to vision as a result of dust or film formation on the inner glass surfaces caused by failure of the hermetic seal or loss of dehydration, other than through glass breakage, within a 10-year period following installation.

PART 2 PRODUCTS

2.1 GLASS

Glass shall conform to the requirements of ASTM C 1036 unless specified otherwise.

2.1.1 Primary Glass

Type I, Class I, Quality q3, shall be provided for glazing openings not indicated or specified otherwise. Where not otherwise indicated, 1/8-inch thick glass shall be provided for glazing openings up to and including 21 square feet; 3/16-inch thick shall be provided for glazing openings over 21 square feet but not over 36 square feet; 7/32-inch thick shall be provided for glazing openings over 36 square feet but not over 45 square feet.

2.1.2 Heat-Absorbing Glass

Type I, Class 2, Quality q3, Style A or B, 1/4 inch thick, tinted silver color.

2.1.3 Light-Reducing Glass

Type I, Class 3, Quality q3, tinted green color, 80 percent light transmission, 1/4 inch thick.

2.1.4 Tempered Glass

ASTM C 1048, Kind FT, Condition A, Type I, Class 1/4 inch thick.

2.1.5 Glass Mirrors, Larger Than 18 by 30 Inches

Glass shall be Type I, Class 1, Quality q2, 3/16 inch thick for sizes less than 10 square feet and 1/4 inch thick for sizes 10 square feet and larger. One surface of the glass shall have silver coating and copper backing passing the test requirements of FS DD-M-00411. Two coats of clear varnish shall be applied over the copper backing and edges of the mirror. Frames are specified in SECTION: MISCELLANEOUS METAL. Framed glass mirrors up to and including 18 by 30 inches are specified in SECTION: TOILET ACCESSORIES.

2.2 SETTING MATERIALS

2.2.1 Glazing Compound and Preformed Glazing Sealants

Compound and Sealants shall be approved for the application and in accordance with applicable portions of FGMA-01. Materials which will be exposed to view and unpainted shall be gray or neutral color.

2.2.2 Glazing Accessories

As required to supplement the accessories provided with the items to be glazed and to provide a complete installation, including glazing points, clips, shims, angles, beads, setting blocks, and spacer strips. Ferrous metal accessories which will be exposed in the finished work shall have a finish that will not corrode or stain while in service.

PART 3 EXECUTION

3.1 INSTALLATION

Glazing shall be performed in accordance with the approved installation instructions of the glass manufacturer. Damaged or unsatisfactory materials shall be removed and replaced at Contractor's expense.

3.2 CLEANING

Glass surfaces shall be thoroughly cleaned with labels, paint spots, putty, and other defacement removed, and shall be clean at the time the work is accepted.

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SECTION 09250

GYPSUM WALLBOARD

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 36	(1991) Gypsum Wallboard
ASTM C 475	(1989) Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C 514	(1990) Nails for the Application of Gypsumboard
ASTM C 630	(1991) Water-Resistant Gypsum Backing Board
ASTM C 645	(1988) Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board
ASTM C 754	(1988) Installation of Steel Framing Members to Receive Screw-Attached Gypsum
ASTM C 840	(1988) Application and Finishing of Gypsum Board
ASTM C 954	(1986) 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	(1988) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Track), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases
ASTM C 1002	(1988) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases

ASTM C 1047 (1985; R 1990) Accessories for Gypsum Wallboard and Gypsum Veneer Base

UNDERWRITERS LABORATORIES (UL)

UL-05 (1992) Fire Resistance Directory

1.2 DESIGN REQUIREMENTS

Except where otherwise indicated or specified, the work shall conform to and shall be applied as indicated in the finish schedule. Furring, blocking, and nailers for attaching wallboard are specified in SECTION: ROUGH CARPENTRY.

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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-04, Drawings

Steel Framing; GA. Control Joints; FIO. Fire-Resistant Assemblies; GA.

Drawings and installation details for ceiling framing and furring, for special wall framing, and for framed openings in walls and ceilings.

1.3.2 SD-13, Certificates

Gypsum Wallboard; GA. Water-Resistant Gypsum Board; GA.

Certificates shall state that the steel framing and wallboard meet the specified requirements.

1.4 DELIVERY AND STORAGE

Wallboard delivered prior to use shall be stored off the ground within a completely enclosed structure or completely enclosed within a weathertight covering. Wallboard shall be dry, free of warpage, and have bundling tape intact immediately prior to use. Application shall commence only after the structure is completely weathertight.

PART 2 MATERIALS

2.1 MATERIALS

Materials shall conform to the requirements specified below. Miscellaneous items not otherwise specified shall be as recommended by the wallboard manufacturer and approved prior to use. The long edges of wallboard shall be tapered, except when used as a base layer in a double layer application. Power driven fasteners may be used only when approved in writing. Thickness of wallboard shall comply with the systems, as detailed on the drawings.

2.1.1 Steel Framing, Furring, and Related Items

Items shall conform to ASTM 645 and ASTM C 955.

2.1.2 Gypsum Wallboard

ASTM C 36; regular or Type X (Special Fire-Resistant), as required; 48-inches wide.

2.1.3 Water-Resistant Gypsum Board

ASTM C 630; surface shall be paintable; regular, as required; 48-inches wide.

2.1.4 Joint Treatment Materials

ASTM C 475.

2.1.4.1 Taping or Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum wallboard joints and fastener heads and completely compatible with tape and substrate.

2.1.4.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.4.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape and substrate.

2.1.4.4 Joint Tape

Reinforcing tape recommended by the manufacturer.

2.1.5 Nails

ASTM C 514.

2.1.6 Screws

ASTM C 1002, Type G for attachment of gypsum board to gypsum board, Type S for attachment to light-gauge steel members, Type W for attachment to wood members; ASTM C 954 for attachment to steel members 0.033- to 0.112-inch thick.

2.1.7 Accessories

ASTM C 1047, Cornerbeads, edge trim, and control (expansion) joints shall be corrosion protective-coated steel designed for the intended use. Flanges shall be free of dirt, grease, and other materials that may adversely affect the bond of joint treatment.

PART 3 EXECUTION

3.1 STEEL FRAMING

Installation of steel framing shall conform to ASTM C 754, except that limiting heights shall be according to manufacturer's current published data. Framing shall be spaced as detailed on the drawings with a maximum of 24 inches on center.

3.1.1 Partition Framing System

Metal framing and furring system shall be capable of carrying a transverse load of 5 psf without exceeding either the allowable stress or a deflection of L/240.

3.1.2 Special Framing

Framing for beams, columns, soffits, and other special items shall be built to the sizes, shapes, or forms indicated and shall be rigidly secured to each intersection with wallboard screws.

3.1.3 Ceiling Openings

Support members shall be provided at ceiling openings such as required for access panels, recessed light fixtures, and for air supply or exhaust. Support members of 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, although not a part of the structural system, shall be provided for attachment or suspension of support members.

3.1.4 Wall Openings

For wall openings such as required for doors, pass-through openings, and access panels, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Partitions abutting continuous suspended ceilings shall be strengthened for rigidity at rough openings, such as door openings, of more than 30-inches wide. Studs at openings shall be 20 gauge minimum bare metal thickness and spot grouted at jamb anchor inserts. Double studs shall be fastened together and secured to floor and overhead runners with screws.

3.2 CONTROL JOINTS

Control joints shall be installed in as recommended by the manufacturer and be in accordance with the following additional requirements: ceiling-height door frames may be used as vertical control joints for partitions; door frames of less than ceiling height may be used as control joints only if standard control joints extend to the ceiling from both corners of the top of door frame; control joints in the ceiling shall be located to intersect column penetrations. In wall lengths over 30 feet, window openings shall be treated in same manner as shown for doors.

3.3 APPLICATION OF GYPSUM WALLBOARD

Gypsum wallboard shall be applied to framing and furring members in accordance with ASTM C 840 and the requirements specified herein except when fire-resistant assemblies are required. Gypsum wallboard shall be applied with separate boards in moderate contact without forcing in place. End joints of adjoining boards shall be staggered. Abutting end and edge joints shall be neatly fitted. Use gypsum wallboard of maximum practical length. Gypsum wallboard shall be cut as required to make neat close joints around openings. In vertical application of gypsum wallboard, panels shall be of length required to reach full height of vertical surfaces in one continuous piece. Surfaces of gypsum wallboard and substrate members may be adhered together with an adhesive, except adhesive shall not be used in lieu of fasteners for fire-rated assemblies. In single-ply installations and the first layer in a multi-ply installation, all ends of gypsum wallboard shall occur over framing members or other solid backing except where treated joints occur at right angles to framing or furring members. Casing beads shall be provided at the edges of gypsum wallboard abutting dissimilar surfaces.

3.3.1 Backing Board

Gypsum wallboard and water-resistant gypsum backing board used as a substrate to receive ceramic tile shall be in accordance with ASTM C 840, System X.

3.4 FINISHING OF GYPSUM WALLBOARD

Gypsum wallboard shall be taped and finished in accordance with ASTM C 840. Joint, fastener depression, and corner treatment shall be provided. Finish surface shall be smooth for paint application. Spray or hand texturing is not acceptable.

3.5 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated gypsum wallboard construction is indicated, the fire-rated assembly shall be in accordance with the specifications contained in the UL-05 for the Design Number indicated.

3.6 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum wallboard smooth, uniform in appearance, and ready to receive finish as specified.

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SECTION 09310

CERAMIC TILE

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 A108.1	(1985) Installation of Grout in Ceramic Tile with Portland Cement Mortar
ANSI A108.5	(1985) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
ANSI A108.10	(1985) Installation of Grout in Tilework
ANSI A118.1	(1985) Dry-Set Portland Cement Mortar
ANSI A118.2	(1985) Conductive Dry-Set Portland Cement Mortar
ANSI A118.4	(1985) Latex-Portland Cement Mortar
ANSI A137.1	(1988) Ceramic Tile

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 144	(1991) Aggregate for Masonry Mortar
ASTM C 150	(1989) Portland Cement
ASTM C 206	(1984; R 1988) Finishing Hydrated Lime
ASTM C 207	(1979; R 1988) Hydrated Lime for Masonry Purposes

TILE COUNCIL OF AMERICA

TCA-01	(1992) 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: SUBMITTAL DESCRIPTIONS.

1.2.1 SD-13, Certificates

Tile; GA.

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

1.2.2 SD-14, Samples

Tile; GA.

Samples of tile of sufficient size to show color range, pattern, tile 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 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 3 days after completion of the work.

PART 2 PRODUCTS

2.1 TILE

2.1.1 Ceramic Tile

Tile shall be standard grade Endicott 3-5/8" x 7-1/4" x 1/2" smooth dark iron spot conforming to ANSI A137.1 or equivalent. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Colors listed are for color identification purposes only; the listing is not intended to limit selection of similar colors from other manufacturers.

2.2 SETTING-BED

2.2.1 Portland Cement

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

2.2.2 Sand

Sand shall conform to ASTM C 144.

2.2.3 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 Dry-Set Portland Cement Mortar

ANSI A118.1.

2.4.2 Conductive Dry-Set Mortar

ANSI A118.2.

2.4.3 Latex-Portland Cement Mortar

ANSI A108.5 and ANSI A118.4.

2.4.4 Portland-Cement Grout

ANSI A108.10; and portland cement grout.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the requirements to ANSI A108.1 for surface conditions for the type setting bed specified and for workmanship.

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. Tile 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. No special accessories shall be used.

3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with the TCA-01, method W-221 for solid backing; and, method W-241 for metal studs.

3.3.1 Dry-Set Mortar and Latex-Portland Cement Mortar

Dry-set Latex-portland cement shall be used to install tile directly over clean, sound, dimensionally stable masonry in accordance with ANSI A108.5.

3.4 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with TCA-01, method F111, F112, or W-223-88 for solid backing only.

3.4.1 Plastic or Cured Mortar Bed

Floor tile shall be installed over a plastic mortar bed or a cured mortar bed at the option of the Contractor. Plastic mortar bed materials and installation shall conform to ANSI A108.1. Cured mortar bed and materials shall conform to ANSI A108.1. Dry-set mortar method of installing tile over a cured mortar bed shall conform to ANSI A108.5. Joints between quarry tile shall be between 1/4 inch and 3/8 inch in width.

3.4.2 Dry-Set

Dry-set mortar shall be used to install tile directly over properly cured, plane, clean concrete slabs in accordance with ANSI A108.5.

3.4.3 Portland Cement Grout

Portland-cement grout shall be prepared and installed in accordance with ANSI A108.10.

3.5 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with ANSI A108.1. 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 at Contractor's expense.

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SECTION 09510

ACOUSTICAL CEILINGS

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	(1991) Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(1991) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E 1264	(1990) Standard Classification for Acoustical Ceiling Products

UNDERWRITERS LABORATORIES (UL)

UL-05	(1992) Fire Resistance Directory

1.2 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units mechanically mounted on a suspended ceiling system. The unit size, texture, finish, and color shall be as specified herein. 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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-01, Data

Acoustical Ceiling System; GA.

Manufacturer's descriptive data and installation instructions.

1.3.2 SD-04, Drawings

Acoustical Ceiling System; GA.

Drawings shall show suspension system, method of anchoring and fastening, and reflected ceiling plan.

1.3.3 SD-13, Certificates

Fire Resistive Ceilings; FIO. Ceiling Sound Transmission Class and Test; FIO.

Test reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified fire endurance and sound transmission requirements. Data attesting to conformance of the proposed system to Underwriters Laboratories, Inc. requirements for the fire endurance rating listed in UL-05 may be submitted in lieu of test reports.

1.3.4 SD-14, Samples

Acoustical Units; GA.

Two samples of each type of acoustical unit showing texture, finish, and color.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed to assure temperature and moisture conditions.

1.5 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 60 degrees F nor more than 80 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 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 Metal Pans

Type: V pans and acoustical insulation pads.
NRC grade: 55 minimum when tested on mounting No. 7.
Pattern: .098" diameter.
Nominal size: 18" x 10-10" holes at .217" in line centers, open areal.
20 gauge (0.036").

Edge detail: Manufacturer's standard.
Joint detail: Beveled.
Finish: Manufacturer's standard bright anodized aluminum.
Pads: Completely enclosed, of material and thickness required for acoustical and fire test ratings.
LR grade: 2.

2.2 SUSPENSION SYSTEM

Suspension system shall be metal-pan-type as shown on drawings, and shall conform to ASTM C 635 for intermediate-duty systems. Surfaces exposed to view shall be aluminum with a clear anodized finish. Wall molding shall have a flange of not less than 15/16 inch and shall be provided with outside corner caps. Inside corner caps shall be provided where, due to the configuration of the installation, they are needed to produce a workmanlike appearance.

2.3 HANGERS

Hangers shall be galvanized steel wire. Hangers and attachment shall support a minimum 300-pound ultimate vertical load without failure of supporting material or attachment.

PART 3 EXECUTION

3.1 INSTALLATION

Acoustical work shall be provided complete with all 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. Splayed hanger wires may be used if an opposite countersplayed wire of the same angle as the first wire is installed and attached to the same supporting member.

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.

3.1.2 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.

3.1.3 Perforated Panels

Install perforated panels according to panel manufacturers approved installation instructions. Edges of panels shall be in close contact with metal supports with each other and in true alignment. Arrange panels so that units less than one-half width are minimized.

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 at the Contractor's expense.

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SECTION 09680

CARPET

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16	(1990) Test Method: Colorfastness to Light
AATCC 165	(1988) Test Method: . Colorfastness to Crocking: Carpets - AATCC Crockmeter Method

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 418	(1982) Pile Yarn Floor Covering Construction
ASTM D 1335	(1967; R 1972) Tuft Bind of Pile Floor Coverings
ASTM D 2257	(1989) Extractable Matter in Textiles
ASTM D 3936	(1980) Delamination Strength of Secondary Backing of Pile Floor Coverings

CARPET AND RUG INSTITUTE (CRI)

CRI-104	(1991) Commercial Carpet Installation Standard

FEDERAL SPECIFICATIONS (FS)

FS DDD-C-0095	(Rev A) Carpets and Rugs, Wool, Nylon, Acrylic, Modacrylic Polyester, Polypropylene

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: SUBMITTAL DESCRIPTIONS

1.2.1 SD-06, Instructions

Carpet and Accessories; GA.

Three copies of the manufacturer's printed installation instructions for the carpet, including procedures for an expert installation and covering preparation of substrate, seaming techniques, and recommended adhesives and tapes.

1.2.2 SD-13, Certificates

Carpet and Accessories; GA.

Certificates of compliance attesting that carpet and cushion materials conform to the standards specified.

1.2.3 SD-14, Samples

Carpet and Accessories; GA.

a. Carpet: Two samples 12 inches by 18 inches of each carpet proposed for use, showing quality, pattern, and color specified.

SD-19 Operation and Maintenance Manuals

Carpet and Accessories; GA.

Three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, and related information. Materials shall be stored in a clean, dry, well ventilated area, protected from damage and soiling, and maintained at a temperature above 60 degrees F for 2 days prior to installation.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained at a temperature above 60 degrees F for 2 days before installation, during installation, and for 2 days after installation. A minimum temperature of 55 degrees F shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Physical Requirements

Carpet shall be of tufted, woven, fusion-bonded, or knitted construction; free of visual blemishes, streaks, poorly dyed areas, and manufacturing defects. Carpet materials and treatments shall be nontoxic, reasonably nonallergenic, and free of other recognized health hazards. Carpet shall conform to the following:

a. Pile surface texture: Textured Loop.

b. Pile fiber: 100 percent nylon with static control

c. Pile weight: 26 ounce per square yard minimum.

d. Pile density: 130 minimum, (11.0 pile units per inch).

e. Width: 12 feet minimum useable carpet.

f. Pattern and color: Lexus or equal.

2.1.2 Surface Texture, Loop Pile

Textured looped surface carpet shall consist of textured uncut pile to create an overall directional surface. Maximum differential between finished pile heights (high and low pile loops) of textured pile shall be 0.125 inch.

2.1.2.1 Pile Yarn

Yarn shall be carpet-type fiber which has never been reclaimed from any woven, tufted, knitted, or felted products. Spun yarn of at least 2-ply construction shall be provided for loop pile carpets with sufficient twist to develop adequate yarn characteristics to ensure high wearability and to minimize pilling and fuzzing of the finished carpet. Do not use undrawn fiber in spun yarn. Plied yarns shall be provided which have a twist in the opposite direction to the singles. The yarn setting method used shall be sufficient to assure permanent texture retention under normal use conditions, cleaning, and shampooing. Autoclave or continuous heat-set shall be used on yarns for friezes and for plush-cut pile constructions requiring tuft definition. Yarns for velvet surface plush-cut pile constructions requiring tuft definition may be crimp-set. Fiber denier and staple lengths may be subject to normal manufacturing tolerances with the following limitations:

a. Acceptable variance in staple length plus or minus 10 percent.

b. Acceptable denier variance, plus or minus 10 percent in individual filament denier and plus or minus 3 percent in average denier.

c. Continuous filament nylon shall not be less than second generation continuous high bulk or textured carpet type fiber with average filament size of 15 denier or coarser modified to provide increased translucence or opacity for soil hiding.

d. Extractable matter in finished yarn shall comply with ASTM D 2257 and shall be not more than 2 percent extracted using a single solvent, as follows:

(1) Nylon-cylohexane,

(2) Acrylic-chloroform

(3) Modacrylic-ether or HH solvent

(4) Polypropylene cold isopropanol

e. Dry and wet crocking shall comply with AATCC 165 and shall have a minimum rating of step 4 on the AATCC Color Transference Chart for all colors.

f. Colorfastness to light shall comply with AATCC 16 and shall have a minimum 4 grey scale rating after 40 hours.

g. Delamination strength for tufted carpet with a secondary back shall be minimum of 2.5 lb./inch in accordance with ASTM D 3936.

2.1.2.2 Pile Density and Thickness

Pile density shall be calculated as follows: 130

Density= (Pile weight x 36)/Pile Thickness

Pile thickness shall be in accordance with ASTM D 418.

2.1.2.3 Backing Materials

Backing materials shall be those customarily used and accepted by the trade for each type of carpet tufted. Carpet shall have a secondary backing except when a special unitary back designed for direct gluedown is provided.

2.1.2.4 Tuft Bind

Tuft bind shall be a minimum 9-pound average force for loop pile and 4 pounds for cut pile when tested in accordance with ASTM D 1335.

2.2 CARPET CUSHION

Carpet cushion shall be first quality, free of blemishes and other physical and manufacturing defects. Cushion materials and treatments shall be reasonably nonallergenic, nontoxic, and free of other recognized health hazards and shall conform to the following:

2.2.1 Attached Cushion

Attached cushion shall comply with FS DDD-C-0095 Class I or Class II rubber.

2.3 ADHESIVES AND CONCRETE PRIMER

Adhesive and concrete primer for installation of carpet shall be waterproof, nonflammable, and as recommended by the carpet manufacturer. Seam adhesive shall be waterproof, nonflammable, and nonstaining as recommended by the carpet manufacturer.

2.4 MOLDING

Molding shall be aluminum. Aluminum molding shall be a hammered surface, pinless clamp-down type, designed for the type of carpet being installed. Finish shall be natural color anodized. Floor flange shall be a minimum 1-1/2 inches wide and face shall be a minimum 5/8 inch wide.

2.5 TAPE

Tape for seams shall be as recommended by the carpet manufacturer for the type of seam used in installation.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, or rough areas shall be repaired using material recommended by the carpet or adhesive manufacturer. Floor shall be free of any foreign materials and swept broom clean.

3.2 MOISTURE TEST

After concrete floor surfaces have been cleaned, small patches of adhesive to be used shall be spread in several locations in each area and allowed to dry overnight. If the adhesive can be peeled easily from the floor surfaces, the floor is not sufficiently dry. The test shall be repeated until the adhesive adheres properly. When the adhesive adheres tightly to the floor surface, the carpet shall be applied. Where concrete floors are in contact with the ground or over unventilated crawl spaces, small patches of primer shall be used in lieu of adhesive to test for moisture.

3.3 INSTALLATION

Installation shall be in accordance with the manufacturer's instructions and CRI-104.

3.3.1 Carpet

Carpet shall be installed direct glue down and shall be smooth, uniform, and secure, with a minimum of seams. Side seams shall be run toward the light where practical and where such layout does not increase the number of seams. Breadths shall be installed parallel, with carpet pile in the same direction. Patterns shall be accurately matched. Cutouts, as at door jambs, columns and ducts shall be neatly cut and fitted securely. Seams at doorways shall be located parallel to and centered directly under doors. Seams shall not be made perpendicular to doors or at pivot points. Seams at changes in directions of corridors shall follow the wall line parallel to the carpet direction.

3.3.2 Seams

Seams shall be uniform, unnoticeable, and treated with a seam adhesive.

3.3.3 Molding

Edges of carpet meeting hard surface flooring shall be protected with molding. Installation shall be in accordance with the molding manufacturer's instructions.

3.4 CLEANING AND PROTECTION

3.4.1 Cleaning

After installation of the carpet; debris, scraps, and other foreign matter shall be removed. Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Protruding face yarn shall be cut off and removed. Carpet shall be vacuumed clean.

3.4.2 Protection

The installed carpet shall be protected from soiling and damage with heavy, reinforced, nonstaining kraft paper or polyethylene film until removal of protective material is directed. Edges of protection shall be lapped and secured to provide a continuous cover.

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SECTION 09900

PAINTING, GENERAL

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 TT-C-535	(Rev B; Am 2) Coating, Epoxy, Two Component, for Interior Use on Metal, Wood, Wallboard, Painted Surfaces, Concrete and Masonry
FS TT-C-542	(Rev E) Coating, Polyurethane, Oil-Free, Moisture-Curing
FS TT-P-29	(Rev J; Am 1, Int Am 2) Paint, Latex Base, Interior, Flat, White and Tints

FEDERAL STANDARDS (FED-STD)

FED-STD 595	(Rev B) Colors

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 7	(1989) Brush-Off Blast Cleaning

1.2 DEFINITION

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.

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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-01, Data

Materials; GA.

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 color is 50 gallons or less.

1.3.2 SD-06, Instructions

Mixing and Thinning; FIO. Application; FIO.

Manufacturer's current printed product description, material safety and technical data sheets for all coating systems. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-cure polyurethane, and liquid glaze coatings. For the liquid glaze coatings, the instructions shall also include surface preparation requirements and the number and types of coats required for each surface. Detailed application instructions for textured coatings shall be included.

1.3.3 SD-09, Reports

Materials; GA.

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.

1.3.4 SD-14, Samples

Coating; GA.

A complete moisture-cured polyurethane coating 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 glaze coating system.

1.4 PACKAGING, LABELING, AND STORAGE

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 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. Emulsion paints shall be stored to prevent freezing.

1.5 COLORS AND TINTS

Colors shall conform to FED-STD 595. Tinting of vinyl-type 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.

1.6 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.

1.7 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, moisture-cure polyurethane, and liquid glaze coatings. Water-thinned coatings will be applied only when ambient temperature is between 50 and 90 degrees F. Epoxy, moisture-cure polyurethane, and liquid glaze coatings will be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-cure polyurethane will not be applied when the relative humidity is below 30 percent. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch. In no case shall paint be applied to surfaces which have visible frost or ice.

PART 2 PRODUCTS

2.1 MATERIALS

Materials shall conform to the respective specifications listed for use in PART 3 EXECUTION and to the requirements herein except when the required amount of a material of a particular color is 50 gallons or less, in which case an approved first-line proprietary paint material with similar intended usage and color to that specified may be used.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

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. Exposed ferrous metals, including nails on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas. All surfaces 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 100 degrees F. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Items removed prior to painting shall be replaced when painting is completed.

3.1.1 Concrete

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. Glaze,

efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting.

3.1.1.1 Interior Exposed Concrete

All exposed surfaces to be cleaned after brush sandblasting and sealed with a clear penetrating water sealer.

3.1.1.2 Exposed Concrete Floors

Exposed concrete floors to be sealed with a clear epoxy coating.

3.1.2 Ferrous Surfaces

Ferrous surfaces that have not been shop-coated shall be solvent-cleaned. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned by sandblasting according to SSPC SP 7.

3.1.3 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 dry cloth, or vacuum-cleaning prior to application of the first-coat material.

3.1.4 Wood Surfaces

Wood surfaces to be sealed shall be cleaned of foreign matter. Surfaces shall be checked to insure that finishing nails have been properly set. After priming, all 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 with sandpaper. Putty or wood filler used shall be compatible with subsequent coatings. Painting shall proceed when the moisture content of the wood does not exceed 12 percent as measured by a moisture meter, unless otherwise authorized.

3.1.4.1 Interior Wood Surfaces

Interior wood surfaces including maple paneling, trim, doors and jambs and cabinet work to receive one coat of sanding sealer to be followed by hand sanding to fill void grain. After smooth surface is obtained two coats of clear polyurethane sealer are to be spray applied.

3.2 MIXING AND THINNING

Unless otherwise recommended by the manufacturer, paints may be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon when necessary to suit conditions of surface, temperature, weather, and application methods. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Paints of different manufacturers shall not be mixed.

3.2.1 Epoxy, Moisture-Cure Polyurethane

Two-component systems shall be mixed in strict 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.

3.3 APPLICATION

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. Floor sealer shall be given additional touch-up coats as necessary to eliminate dull spots. Excess sealer shall be wiped off after each application.

3.3.1 Ventilation

Adequate ventilation shall be provided during paint application. Respirators shall be worn by all persons engaged in spray painting. Adjacent areas shall be protected by approved precautionary measures.

3.3.2 First Coat

The first coat on 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. The first coat on both faces of wood doors shall be applied at essentially the same time. Each coat of clear sealer shall be sanded lightly prior to application of subsequent coats.

3.3.3 Time Between Surface Preparation and Painting

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.

3.3.4 Coating Progress

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.

3.3.5 Epoxy and Moisture-Cure Polyurethane

Manufacturer's instructions for application, curing and drying time between coats will be followed. Except for liquid glaze coatings, second coats shall be applied at a maximum spreading rate of 450 square feet per gallon. The total coating system thickness for liquid glaze coatings, including a top or glaze-coat thickness of 3 mils, shall not be less than 8 mils.

3.4 SURFACES TO BE PAINTED

Surfaces listed in the PAINTING SCHEDULE, other than those listed in paragraph: SURFACES NOT REQUIRING PAINTING, will receive the surface preparation, paints, and number of coats prescribed in the schedule.

3.5 SURFACES NOT REQUIRING PAINTING

The following listed items will not require painting: exterior faces of precast concrete wall (both aggregate faces and sandblasted edges); any miscellaneous and structural sandblasted ferrous metal systems; galvanized roof and celing decking; any mechanical ducts or exposed piping; all cables at railings and perforated metal ceilings. The building uses natural untreated or clea sealed surfaces extensively and every care should be used to maintain and protect these surfaces from staining and marring during the construction process.

3.6 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.

3.7 PAINTING SCHEDULE

The "PAINTING SCHEDULE" at the end of this section prescribes the surfaces to be painted, and the number and types of coats of paint required.

3.7.1 Shop-Painted Items

Surfaces of items finish-painted by the manufacturer, or specified to be finish-painted under other sections of the specifications, are exempted from the requirements for surface preparation and painting. Shop-primed items shall receive surface preparation and finish painting as required by this section.

PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
Interior concrete.	clear penetrating water sealer		
Interior gypsum board.	FS TT-P-29	FS TT-P-29	
Exposed interior concrete floors.	FS TT-C-535		
Wood interior trim, paneling doors	sanding	FS TT-C-542	FS TT-C-542

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TOILET PARTITIONS

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SECTION 10160

TOILET PARTITIONS

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 RR-P-1352 (Rev C) Partitions, Toilet, Complete

1.2 DESCRIPTION

Toilet partitions, including toilet enclosures, and urinal screens, shall conform to the layouts shown. Materials shall be stainless steel as selected from the manufacturer's standard products.

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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-04, Drawings

Toilet Partitions; GA.

Drawings shall show plans, elevations, details of construction, hardware, reinforcing, fittings, mountings, and anchorings.

1.3.2 SD-14, Samples

Toilet Partitions; GA.

Manufacturer's samples of brushed stainless steel.

PART 2 PRODUCTS

2.1 TOILET ENCLOSURES

Toilet enclosures shall conform to FS RR-P-1352, Type I, Style C. Width of toilet enclosures shall be as shown. Finish surface of panels shall be stainless steel. Panel indicated to receive toilet paper holders or grab bars as specified in SECTION: TOILET ACCESSORIES shall be reinforced for the reception of the items required.

2.2 URINAL SCREENS

Urinal screens shall conform to FS RR-P-1352, Type III, Style D. Finish surface of screens shall be stainless steel. Style D screens shall be 24 inches wide.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet partitions shall be installed straight and plumb with all horizontal lines level and rigidly anchored to the supporting construction. Where indicated, anchorage to walls shall be by through-bolting. Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work.

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. Toilet partitions shall be cleaned and protected from damage until accepted.

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SECTION 10200

FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 SCOPE

This sections includes everything necessary for and incidental to the furnishing and installation of fire extinguishers as indicated on the drawings and as specified herein.

1.2 RELATED WORK BY OTHER SECTIONS

SECTIONS: MISCELLANEOUS METAL FABRICATIONS, FINISH CARPENTRY and GYPSUM WALLBOARD.

1.3 SUBMITTALS

Submit complete manufacturer's data and specifications for approval. See SECTION: GENERAL REQUIREMENTS.

1.4 COMPLIANCE

Any circumstances notwithstanding fire extinguishers shall be in complete compliance with all applicable codes and ordinances.

1.5 QUALITY ASSURANCE

Provide only new equipment which is approved by the Contracting Officer.

PART 2 PRODUCTS

2.1 EXTINGUISHERS

Provide three (3) multi-purpose ABC dry chemical extinguishers or equal for mounting on wall brackets as specified herein and shown on the drawings.

2.2 WALL BRACKETS

Wall brackets shall be recommended by manufacturer of extinguishers.

PART 3 EXECUTION

3.1 INSTALLATION

Install fire extinguishers in accordance with manufacturer's specifications and as indicated on the drawings.

3.2 BLOCKING

Coordinate with other sections of the work for blocking as required.

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EXTERIOR SIGNAGE

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SECTION 10430

EXTERIOR SIGNAGE

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 A117.1	(1986) Providing Accessibility and Usability for Physically Handicapped People

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1991) Structural Steel
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 525	(1991b) General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 570	(1991) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1990) Structural Welding Code - Steel

1.2 GENERAL

Exterior signage shall be of the size and type shown on the drawings, shall conform to the requirements specified herein, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Materials and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.3 SUBMITTALS

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

1.3.1 SD-04, Drawings

Exterior signs; GA.

Drawings including elevations of each type of sign; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction. A schedule showing the location of each sign type shall be included.

1.3.2 SD-14, Samples

Exterior Signs; GA.

One sample of the engraved lettering and directional arrow on a 12 x 12 piece of steel plate with color applied in recessed letter form.

1.4 DELIVERY AND STORAGE

Materials shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area.

PART 2 PRODUCTS

2.1 STEEL PRODUCTS

ASTM A 36 for structural steel, ASTM A 570 for sheet and strip.

2.2 ANCHORS AND FASTENERS

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall match in color and finish.

2.3 SHOP FABRICATION AND MANUFACTURE

2.3.1 Workmanship

Work shall be assembled in the shop, insofar as practicable, ready for installation at the site. Work that cannot be shop assembled shall be given a trial fit in the shop to ensure proper field assembly. Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Weld to or on structural steel in accordance with AWS D1.1. Welding shall be continuous along the entire area of contact. Exposed welds shall be ground smooth. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable. Items specified to be galvanized shall be by hot-dip process after fabrication if practicable. Galvanization shall be in accordance with ASTM A 123 and ASTM A 525, as applicable. Joints exposed to the weather shall be formed to exclude water. Drainage and weep holes shall be included as required to prevent condensation buildup.

2.4 FREE-STANDING BASE MOUNT PYLON/MONOLITH TYPE SIGNS

Drawings show dimensions, mounting heights, messages, lettering, spacing, and mounting details.

2.4.1 Exterior Sheet Panels

Panels shall be provided in sizes as shown on the drawings. Panels shall be fabricated of minimum 1/2 inch thick sandblasted steel. Engraved and cut patterns for letters, arrows, and shapes to be as per drawing. Color in lettering to be chrome yellow unless otherwise specified.

2.5 PLAQUES

Metal plaques for the Corps of Engineers, Maricopa County Flood Control District and the Arizona State University shall be supplied by the respective agencies.

2.5.1 Mounting Method

Plaque mounting method as required by the agency supplied plaque.

2.5.2 Mounting

Permanent mounting shall be provided by embedding posts in concrete foundation as shown.

2.6 GRAPHICS FOR PYLON/MONOLITH AND POST/PANEL TYPE SIGNS

2.6.1 Tactile Graphics

Signage that provides emergency information, general circulation directions, or identification of spaces shall be tactile (perceptible to touch) and shall comply with ANSI A117.1. Characters, symbols, or pictographs on tactile engraved signs shall be raised or recessed 1/32 inch minimum. Raised letters and numbers shall be as shown on drawings. Raised characters or symbols shall be at least 5/8 inch high, but no higher than a nominal 4 inches. Characters and symbols shall contrast in color with their background.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed at locations shown on the drawings. All signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs mounted on other surfaces shall not be installed until finishes on such surfaces have been completed.

3.1.1 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned.

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SECTION 10750

TELEPHONE ENCLOSURE

PART 1 GENERAL

1.1 SCOPE

This section includes everything necessary for and incidental to the furnishing and installing of a telephone booth enclosure as indicated on the drawings and as specified herein.

1.2 WORK RELATED BY OTHER SECTIONS

SECTION: STRUCTURAL STEEL, DIVISION 16: ELECTRICAL.

1.3 PRODUCTS NOT NAMED

See SECTION: GENERAL REQUIREMENTS.

1.4 SUBMITTALS

a. Submit complete manufacturer's data and specifications for approval. See SECTION: GENERAL REQUIREMENTS.

PART 2 PRODUCTS

2.1 TELEPHONE ENCLOSURE

Telephone enclosure shall be semi-circular wall mounted phone enclosure. Approximate size, 27" diameter x 14" deep, all stainless steel.

PART 3 EXECUTION

Coordinate with SECTION: STRUCTURAL STEEL and DIVISION 16 to provide the necessary surface mounting conditions and wiring provisions.

a. Mount unit in accordance with manufacturer's specifications and approved Shop Drawings using concealed type fasteners in location indicated on drawings.

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TOILET ACCESSORIES

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SECTION 10800

TOILET ACCESSORIES

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.

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2380	(Basic) Dispenser, Paper Towel

FEDERAL SPECIFICATIONS (FS)

FS DD-M-00411	(Rev C) Mirrors, Glass
FS WW-D-1908	(Rev A) Holder, Toilet Paper
FS WW-P-541/GEN	(Rev E; Am 1) Plumbing Fixtures
FS WW-H-1911	(Rev A) Holder, Toilet Paper (Single Roll)
FS WW-P-541/8	(Rev B; Am 1) Plumbing Fixtures (Accessories, Land Use)

1.2 SUBMITTALS

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

1.2.1 SD-01, Data

Finishes; GA. Accessory Items; GA.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, and operation instructions.

1.2.2 SD-14, Samples

Finishes; GA. Accessory Items; GA.

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 by the Contracting Officer.

1.3 GENERAL REQUIREMENTS

Toilet accessories as specified herein shall be provided where indicated in accordance with paragraph: SCHEDULE. Each accessory item shall be complete with the necessary mounting plates, anchors, and fasteners. Concealed mounting plates shall be of sturdy construction with corrosion resistant surface.

1.3.1 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 well suited for use with the supporting construction. Where exposed fasteners are permitted, they shall have oval heads and finish to match the accessory.

PART 2 PRODUCTS

2.1 FINISHES

Finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 general purpose

2.2 ACCESSORY ITEMS

Accessory items shall conform to the respective specifications and other requirements specified below. All accessory items shall have a smooth finish.

2.2.1 Grab Bar (GB)

Grab bar shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type IV, Class 2, 1-1/4 inches OD stainless steel. Grab bar shall be form and length as indicated. Flange shall have screw mounting holes concealed on the lip of the flange. Grab bar shall have a smooth finish. Installed bars shall be capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation.

2.2.2 Mirror, Glass (MG)

Glass mirror shall conform to FS DD-M-00411, Class 2, Style [C] [E].

2.2.3 Paper Towel Dispenser (PTD)

Paper towel dispenser, conforming to CID A-A-2380, shall be constructed of not less than 0.0269-inch Type 304 stainless steel, shall be surface mounted, and shall dispense C-fold, single-fold, or quarter-fold towels. Capacity of dispenser shall be at least 400 C-fold or 525 multifold towels. Surface mounted dispenser shall have a towel compartment. Locking mechanism shall be push button or twist-type lock.

2.2.4 Paper Towel Dispenser (PTDHC)

Paper towel dispenser, conforming to CID A-A-2380, shall be constructed of not less that 0.0269-inch Type 304 stainless steel, shall be recessed mounted, and shall dispenser C-fold, single-fold, or quarter-fold towels. Capacity shall be at least 400 C-fold or 700 multifold towels. Recessed mounted dispenser shall have the towel compartment concealed behind a door, and a semi-recessed waste receptacle. Waste receptacle shall have a stainless steel removable container. Locking mechanism shall be twist-type lock.

2.2.5 Sanitary Napkin and Tampon Disposer (SND)

Sanitary napkin and tampon disposal shall be constructed of Type 304 stainless steel and be of the disposable liner type and shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type I, Class 1, Style P (partition mounted). Fifty disposable liners of the type standard with the manufacturer shall be provided.

2.2.6 Sanitary Napkin and Tampon Dispenser (SNTD) with Door

Sanitary napkin and tampon dispenser shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type I, Class 5, recessed. Dispenser, including door shall be Type 304 stainless steel and have a capacity of 20 napkins and 20 tampons. Dispensing mechanism shall be for coin operation.

2.2.7 Soap Dispenser (SD)

Soap dispenser shall be liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 40 fluid ounces with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

2.2.8 Shelf, Metal, Light Duty (SMLD)

Light duty metal shelf shall conform to FS WW-P-541/GEN and FS WW-P-541/8, Type V. Shelf shall be supported between brackets or on brackets. Width and length shall be in accordance with paragraph: SCHEDULE. Shelf and separate supports shall be Type 304 stainless steel.

2.2.9 Toilet Tissue Dispenser (TTD)

Toilet tissue holder shall conform to FS WW-H-1911, Type I, roller mounted on two support brackets. Brackets shall be stainless steel. Toilet tissue cabinet shall conform to FS WW-D-1908, stainless steel, containing 2 rolls of tissue.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet accessories shall be securely fastened to the supporting construction in accordance with the approved submittals. Accessories shall be protected from damage from the time of installation until acceptance.

3.2 SCHEDULE

Accessories Required

Room No.	Room Name	Accessories Required
2	Mens Room	GB, PTD, PTDHC, SD, TTD
3	Womens Room	GB, PTD, PTDHC, SD, TTD
6	Workshop	PTDHC, SD
10	Lab	PTDHC, SD

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SECTION 15400

PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

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

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 1010	(1984) Drinking Fountains and Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A112.19.2	(1982) Vitreous China Plumbing Fixtures
ANSI A117.1	(1986) Providing Accessibility and Usability for Physically Handicapped People
ANSI Z21.22	(1986) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1991) Structural Steel
ASTM A 47	(1990) Ferritic Malleable Iron Castings
ASTM A 53	(1990b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 74	(1987) Cast Iron Soil Pipe and Fittings
ASTM B 32	(1989) Solder Metal
ASTM B 42	(1989) Seamless Copper Pipe, Standard Sizes
ASTM B 88	(1989) Seamless Copper Water Tube
ASTM B 370	(1988) Copper Sheet and Strip for Building Construction

ASTM B 641	(1988) Seamless and Welded Copper Distribution Tube (Type D)
ASTM C 564	(1988) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM D 2564	(1991) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2822	(1991) Asphalt Roof Cement
ASTM D 2855	(1990) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(1988) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting Resin) Pipe

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

ASHRAE 90A	(1980; 90A-a) Energy Conservation in New Building Design

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME-13	(1989; Addenda 1989, 1990, 1991) Boiler and Pressure Vessel Code; Section IV, Heating Boilers
ASME A112.6.1M	(1988) Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.14.1	(1975; R 1990) Backwater Valves
ASME A112.19.2M	(1990) Vitreous China Plumbing Fixtures
ASME A112.21.1M	(1991) Floor Drains
ASME A112.36.2M	(1983) Cleanouts
ASME B1.20.1	(1983) Pipe Threads, General Purpose (Inch)
ASME B16.3	(1985) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(1985) Cast Iron Threaded Fittings Classes 125 and 250

ASME B16.12	(1991) Cast Iron Threaded Drainage Fittings
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 B16.39	(1986) Malleable Iron Threaded Pipe Unions (Class 150, 250, and 300)

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	(1981) Water Pressure Reducing Valves for Domestic Water Supply Systems
ASSE 1005	(1986) Water Heater Drain Valves - 3/4-Inch Iron Pipe Size
ASSE 1018	(1986) Trap Seal Primer Valves - Water Supply Fed

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA-01	(1989; 17th Ed) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(1987; B301a-1990) Hypochlorites
AWWA C105	(1988) Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C203	(1986) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(1987) Grooved and Shouldered Joints
AWWA M20	(1973) Water Chlorination Principles and Practices

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI Std 301	(1990) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

CISPI Std HSN	(1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings

COMMERCIAL ITEM DESCRIPTION (CID)

CID A-A-238	(Rev B) Seat, Water Closet

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA 1.0	(Apr 1990) Standard Test Method 1.0 for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube.

FEDERAL SPECIFICATIONS (FS)

FS GG-T-321	(Rev D; Am 2) Thermometers, Self-Indicating, Liquid-in-Glass for Machinery and Piping Systems
FS QQ-L-201	(Rev F; Am 2) Lead Sheet
FS TT-P-1536	(Rev A) Plumbing Fixture Setting Compound
FS TT-S-00230	(Rev C; Am 2) Sealing Compound, Elastomeric Type, Single Component for Calking, Sealing, and Glazing (for Buildings and Other Structures)
FS TT-S-001543	(Rev A) Sealing Compound, Silicone Rubber Base for Calking, Sealing, and Glazing (for Buildings and Other Structures)
FS W-H-196	(Rev J; Int Am 1) Heater, Water, Electric, and Gas Fired, Residential
FS WW-C-440	(Rev B; Am 2) Clamps, Hose (Low-Pressure)
FS WW-N-351	(Rev C; Int Am 1) Nipples, Pipe, Threaded
FS WW-P-541/GEN	(Rev E; Am 1) Plumbing Fixtures
FS WW-P-541/2	(Rev B; Am 1) Plumbing Fixtures (Urinals)
FS WW-P-541/5	(Rev B; Am 1) Plumbing Fixtures (Sinks, Kitchen, Service, and Laundry Trays)

FS WW-P-541/6	(Rev B; Int Am 1) Plumbing Fixtures (Drinking Fountains)
FS WW-P-541/9	(Rev B; Am 1) Plumbing Fixtures (Medical Facilities, Land Use)
FS WW-U-516	(Rev B; Notice 1) Unions, Brass or Bronze, Threaded Pipe Connections and Solder Joint Tube Connections
FS WW-V-35	(Rev C) Valve, Ball

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-44	(1991) Steel Pipe Line Flanges
MSS SP-58	(1988) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(1990) Butterfly Valves
MSS SP-69	(1991) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1990) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-72	(1987) Ball Valves with Flanged or Buttwelding Ends for General Service
MSS SP-73	(1991) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1987; R 1992) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(1987) Steel Pipe Unions Socket-Welding and Threaded

MILITARY SPECIFICATIONS (MS)

MS MIL-T-27730	(Rev A) Tape, Antiseize, Polytetrafluoroethylene, with Dispenser

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

NAPHCC-01	(1990; Supple 1991) National Standard Plumbing Code

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201 (1983) Water Hammer Arresters

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.2.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.2.3 Code

All plumbing work shall be in accordance with NAPHCC-01, unless otherwise stated.

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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-04, Drawings

Plumbing System; GA.

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operations of each system. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; and schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods.

1.3.2 SD-09, Reports

Tests, Flushing and Sterilization; GA.

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

1.3.3 SD-13, Certificates

Materials and Equipment; GA.

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency. Where equipment if specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts; GA.

Written certification that the bolts furnished comply with the requirements of this specification, provided by the bolt manufacturer. The certification shall include illustrations of product-required markings, the date of manufacture, and the number of each type of bolt to be furnished based on this certification.

1.3.4 SD-19, Operation and Maintenance Manuals

Plumbing System; FIO.

Six (6) copies of the operation manual outlining the step-by-step procedures required for system startup, operation and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Six (6) copies of the maintenance manual listing routine maintenance procedures, possible breakdowns and repairs. The manual shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. Pipe fittings shall be compatible with the applicable pipe materials. Pipe threads shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be of the same manufacturer. Material or equipment containing lead shall not be used in any potable water system.

2.1.1 Pipe Joint Materials

Joints and gaskets materials shall conform to the following:

a. Coupling for Cast-Iron Pipe: ASTM A 74, AWWA C606.

b. Couplings for Grooved Pipe: Malleable Iron ASTM A 47, Grade 32510.

c. Neoprene Gaskets for Hub and Cast-Iron Pipe and Fittings: CISPI Std HSN.

d. Brazing Material. Brazing material shall have a liquidus temperature not exceeding 800 degrees F., an operating temperature of 1300-1550 degrees F., and a composition of 2 percent silver, 91 percent copper, 7 percent phosphorus within a maximum deviation of no more than 0.5 percent of all other materials combined.

e. Brazing Flux. Flux shall be in paste or liquid form, be appropriate for use with brazing material, be lead-free, have a 100 percent flushable residue, contain slightly acetic reagents, contain potassium borides, and contain fluorides.

f. Solder Material. Solder metal shall be in conformance with ASTM B 32 95-5 tin - antimony.

g. Solder Flux. Flux shall be liquid form, non-corrosive, and in conformance with CDA 1.0, Standard Test 1.

h. PTFE Tape, for use with Threaded Metal or Plastic Pipe: MS MIL-T-27730.

i. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: PDI WH 201.

b. Copper, Sheet and Strip for Building Construction: ASTM B 370.

c. Lead, Sheet: FS QQ-L-201, Grade B.

d. Asphalt Roof Cement: ASTM D 2822.

e. Hose Clamps: FS WW-C-440.

f. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

g. Metallic Cleanouts: ASME A112.36.2M.

h. Plumbing Fixture Setting Compound: FS TT-P-1536, Type II.

i. Hypochlorites: AWWA B300.

j. Liquid Chlorine: AWWA B301.

k. Thermometers: FS GG-T-321.

2.1.3 Pipe Insulation Material

All hot water piping will be insulated with 3/4" thick minimum density 4.0 lbs. per cubic foot fiberglass. Thermal conductivity "K" value not to exceed 0.24 at 75 degree F. mean temperature. Provide metal jacket at all exposed locations. Chilled water supply pipe from P-5 remote chiller to be insulated with 1/2" thick, pre-formed, fiberglass pipe insulation.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports installation shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves in connection with runouts, risers, branches, and mains shall be installed where indicated. Valves shall be gate valves, unless otherwise specified or indicated. Valves 2-1/2 inches and smaller shall be bronze, with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Valves used for water service shall have the zinc content limited to no more than 6 percent for the stem, body, bonnet, wedge, or disk in contact with the fluid. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of the applicable published standard.

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves	FS WW-V-35
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Backwater Valves	ASME A112.14.1
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22 and ASME-13

2.3.1 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4-inch male inlet threads, hexagon shoulder, and 3/4-inch hose connection. Faucet handle shall be securely attached to stem.

2.3.2 Relief Valves

Water heaters shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve must have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input by the heaters. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves rated according to ANSI Z21.22 shall be selected for systems where the input rating of the heaters is less than 200,000 Btuh. A minimum relief valve size shall be 3/4 inch for inlet and outlet for heaters less than 200,000 Btuh.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with the National Standard Plumbing Code. Fixtures for use by the physically handicapped shall be in accordance with ANSI A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature. Plumbing fixtures shall generally be in accordance with FS WW-P-541/GEN, and shall be as indicated in Plumbing Fixture Schedule attached at the end of this section of the specifications.

2.5 DRAINS

2.5.1 Floor Drains (P-6 on drawings)

Floor drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded or caulked connection. In lieu of a caulked joint between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.21.1M.

2.6 TRAPS

Unless otherwise specified herein, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be not less than 20-gauge copper alloy with walls 0.032-inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and treaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint. Traps requiring priming to be filled with an auxillary fitting for trap priming needs.

2.7 WATER HEATER (PE-1 and PE-2 on drawings)

Water heater types and capacities shall be as indicated.

2.7.1 Automatic Storage Type

The thermal efficiency and standby heat loss shall comply with the requirements of ASHRAE 90A. Heaters shall be complete with control system, temperature gauge, and shall have ASME rated combination pressure and temperature relief valve.

2.7.1.1 Electric Type

Electric type water heaters shall conform to FS W-H-196, Type II or Type IV, Series 1. Electric water heaters, 80 gallons or less, shall have a maximum total power input of 4500 watts and shall be provided with dual heating elements. The size, capacity, voltage, and combined wattage of heating elements shall be not less than indicated.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Neither hubless cast-iron soil pipe nor plastic pipe shall be installed under concrete floor slabs. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A gate valve on the water service line shall be installed as indicated. Piping shall be connected to the exterior service lines or capped or plugged, if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. All exterior underground utilities shall be at least 12 inches below the finish grade or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed horizontal or above.

3.1.1 Soil, Waste, Drain, and Vent Piping

No joint shall be located within 6 inches of any floor.

3.1.1.1 Roof Penetrations

Metallic pipe shall be used through the roof from at least 6 inches below the roof to the required point of termination above the roof.

3.1.1.2 Floor/Ceiling Penetrations

Metallic pipe shall be used through the floor/ceiling from at least 6 inches below the ceiling to at least 6 inches above the floor.

3.1.2 Water Pipe, Fittings, and Connections

3.1.2.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shut-off valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, and flush valves shall be anchored to prevent movement.

3.1.2.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved at the Contractor's expense.

3.1.2.3 Protection to Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.2.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Care shall be taken not to weaken structural portions of the building. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings will be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Changes in pipe sizes shall

be made with reducing fittings. Use of bushings will not be permitted. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.2.5 Pipe Drains

Pipe drains indicated shall consist of 3/4-inch hose bibb with renewable seat and gate valve or ball valve ahead of hose bibb. At other low points, 3/4-inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.2.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops where indicated and required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.3 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted.

3.1.3.1 Mechanically Coupled

Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous, domestic hot-and cold-water systems in lieu of unions, welded, flanges, or threaded joints. Mechanical couplings are permitted in accessible locations, including behind access plates. Flexible grooved joints will not be permitted, except as vibration isolators adjacent to mechanical equipment. Rigid grooved joints shall incorporate an angle bolt pad design which maintains metal-to metal contact with equal amount of pad offset of housings upon installation to ensure positive rigid clamping of the pipe. Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications will not be permitted. Rigid grooved pipe couplings shall be for use with grooved end pipes, fittings, valves and strainers. Rigid couplings shall be designed for not less than 125 psi service and appropriate for static head plus the pumping head, and shall provide a water-tight joint. Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally welded elbows shall not be used. Grooves shall be

prepared in accordance with the coupling manufacturer's latest published standards. Grooving shall be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations. The Contracting Officer shall be notified 24 hours in advance of test to demonstrate operator's capability, and the test shall be performed at the work site, if practical, or at an agreed upon site. The operator shall demonstrate the ability to properly adjust the grooving tool, groove the pipe, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications.

3.1.3.2 Union and Flanged

Unions and flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

3.1.3.3 Copper Tube and Pipe

Joints shall use fittings made for the purpose, have clearances of 0.001 to 0.003", be brazed, and be made with flux. Tubes shall be cut square and reamed to remove burrs. The outside surface of the tube to contact the fitting and inside surface of the fitting shall be cleaned with an abrasive material just prior to making connections. Care shall be taken to prevent annealing of the tube or fittings when making connections. Connections of 2-1/2" and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multiflame torch.

a. Brazed. Brazed joints shall be made in conformance with MSS SP-73, with flux and are acceptable for all line sizes. Excess flux and brazing material shall be wiped off the line and fitting exterior before it dries and hardens. Excess flux or brazing material on the inside surface of the tube or fitting shall be avoided.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for lines 2 inches and smaller. Joints shall be heated to 850 degrees F before the solder is applied.

c. Copper Tube Extracted Joint. An extracted mechanical joint may be made in copper tube. Joint shall be produced with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, dimpled depth stops shall be provided. Also branch tube shall be notched for proper penetration into fitting to ensure a free flow joint. Extracted joints shall be brazed in accordance with NAPHCC-01 using B-Cup series filler metal in accordance with MSS SP-73. Soldered extracted joints will not be permitted.

3.1.4 Dissimilar Pipe Materials

Connections to water heaters and connections between ferrous and copper pipe shall be made with dielectric unions or flanges. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.5 Corrosion Protection for Pipe and Fittings

Buried cast-iron soil piping shall be completely encased in polyethylene tube or sheet in accordance with AWWA C105. Exterior surfaces of steel pipe and fittings installed underground shall be coated with primer and wrapped with tape during installation. Tape shall conform to AWWA C203 and primer shall be as recommended by the tape manufacturer. After thoroughly cleaning piping of foreign matter, the pipe shall be primed and immediately wrapped with tape, applied with a 50 percent overlap. Joints and fittings shall be coated and wrapped with the same primer and tape after piping has been tested in accordance with NAPHCC-01.

3.1.6 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.6.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall not be required for cast-iron soil pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve with corrosion-protected carbon steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4-inch clearance all-around between bare pipe and inside of sleeve or between jacket over insulation and sleeves. Sleeves in bearing walls shall be steel pipe or cast-iron pipe. Sleeves for membrane waterproof floors shall be steel pipe, cast-iron pipe, or plastic pipe. Membrane clamping devices shall be provided on pipe sleeves for waterproof floors. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or moisture-resistant fiber or plastic. Plastic sleeves shall not be used in nonbearing fire walls, roofs, or floor/ceilings. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated and with sealants conforming to FS TT-S-00230 or FS TT-S-001543 and with a primer, backstop material and surface preparation as specified in SECTION: CAULKING AND SEALANTS. Pipes passing through sleeves in concrete floors over crawl spaces shall be sealed as specified above. The annular space between pipe and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below grade walls in contact with earth shall be recessed

1/2 inch from wall surfaces on both sides. Fill annular space between pipe and sleeve with backing material and install sealants in the joint between the pipe and concrete wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant.

3.1.6.2 Flashing Requirements

Pipes passing through roof or floor waterproofing membrane shall be installed through a 4-pound lead flashing or a 16-ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. In addition, a waterproofing clamping flange shall be installed.

3.1.6.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from lead or soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of lead or sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be caulked with oakum and lead to form a seal.

3.1.6.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 6 inches in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.1.6.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixtures drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs: Flashing Requirements and Waterproofing, form a groove 1/4 inch to 1/2 inch wide by 1/4 inch to 3/8 inch deep around the pipe, fitting or drain. Fill the groove with a sealant as specified in SECTION: CAULKING AND SEALANTS. Coordinate these requirements with the General Contractor.

3.1.7 Supports

3.1.7.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. All piping subjected to vertical movement when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.1.7.2 Pipe Supports and Structural Bracing, Seismic Requirements

All piping and attached valves shall be supported and braced to resist seismic loads. Structural steel required for reinforcement to properly support piping, headers, and equipment but not shown shall be provided under this section. Material used for supports shall be as specified under SECTION: STRUCTURAL STEEL.

3.1.7.3 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts and supports installation shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Type 39 saddles shall be used on all insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

(1) be used on all insulated pipe less than 4 inches.

(2) be used on all insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or less.

(3) have a high density insert for pipe 2 inches and larger. High density inserts shall have a density of 8 pcf or greater.

i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over one foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Use 120 degrees F for PVC pipe and 180 degrees F for CPVC as operating temperatures in determining hanger spacing for PVC or CPVC pipe.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations.

k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used.

(1) on pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) on pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) on pipe 4 inches and larger carrying medium less that 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

m. Where there are high system temperatures and welding to piping is not desirable, then the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches, or by an amount adequate for the insulation, whichever is greater.

3.1.8 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single-story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

3.2 RELIEF VALVES

No other valves shall be installed between the relief valve and the water heater. The relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the valve shall be installed directly in a tapping in the tank or heater. When heaters are not provided with a relief valve tapping, the valve shall be installed in the hot-water outlet piping. A discharge pipe the size of the valve outlet shall be connected to the valve outlet and terminated at a safe location. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted within 6 inches above the top of the tank or water heater.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets, shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Flush Valves

Flush valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket.

3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 34 inches above finished floor. Wall-hung drinking fountains, and water coolers shall be installed with rim 32 inches above floor. Wall-hung service sinks shall be mounted with rim 28 inches above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ANSI A117.1.

3.3.4 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.4.1 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.4.2 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 1/4-inch thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

3.3.4.3 Wall-Mounted Water Closet Gaskets

Where wall-mounted water closets are provided, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished shall be as recommended by the chair-carrier manufacturer.

3.3.5 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in SECTION: MISCELLANEOUS METAL.

3.3.6 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps for acid-resisting waste shall be of the same material as the pipe.

3.4 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.5 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in SECTION: PAINTING, GENERAL.

3.6 TESTS, FLUSHING, AND STERILIZATION

3.6.1 Plumbing System

The plumbing system shall be tested in accordance with NAPHCC-01.

3.6.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated at the Contractor's expense. Repairs to piping shall be made with new materials. No caulking of screwed joints or holes will be acceptable.

3.6.3 System Flushing

After tests are completed, potable water piping shall be flushed. In general, sufficient water shall be used to produce a minimum water velocity of 2.5 feet per second through piping being flushed. Flushing shall be continued until discharge

water shows no discoloration. System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced in line. After flushing and cleaning, systems shall be prepared for service by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building, due to the Contractor's failure to properly clean the piping system, shall be repaired by the Contractor. When the work is complete, the hot-water system shall be adjusted for uniform circulation. Flush valves and automatic control devices shall be adjusted for proper operation.

3.6.4 Operational Test

Upon completion of and prior to acceptance of the installation, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve, hydrant, and faucet.

e. Temperature of each domestic hot-water supply.

f. Operation of each floor and roof drain by flooding with water.

g. Operation of each vacuum breaker and backflow preventer.

3.6.5 Sterilization

After pressure tests have been made, the entire domestic hot- and cold-water distribution system shall be sterilized. System shall be thoroughly flushed with water of sufficient velocity until all entrained dirt and other foreign material have been removed, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Water chlorination procedure shall be in accordance with AWWA M20. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. The chlorine residual shall be checked at intervals to ensure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system being sterilized shall be opened and closed several times during the contact period to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system. Water tanks shall be disinfected by the addition of chlorine directly to the filling water. Following a 6-hour period, no less than 50 ppm chlorine residual shall remain in the tank. The system including the tanks shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several

times. From several points in the system the Contracting Officer will take samples of water in properly sterilized containers for bacterial examination. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA-01. The testing method used shall be either the multiple - tube fermentation technique or the membrane - filter technique. The sterilizing shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained. Contractor shall arrange for laboratory acceptable to Contracting Officer to conduct bacterial exam.

3.7 PLUMBING FIXTURE SCHEDULE

P-1 WATER CLOSET:

Vitreous china, close-coupled flushometer tank, 1.5 gpf ASME A112.19.2M. Floor flange shall be copper alloy, cast iron, or plastic. Gasket shall be wax type.

Seat - CID A-A-238, Type A, black plastic, elongated, open front.

Valve Control -

P-1A WATER CLOSET HANDICAPPED:

Seventeen inches; finished floor line to top of bowl. All other features are the same as P-1.

P-2 URINAL:

Floor stall type FS WW-P-541/2, Vitreous china water saver with integral spreader, 3/4" inlet and spud to conform to ANSI A112.19.2. Flush valve to be low consumption, non-hold open, with vacuum breaker. Provide with bottom strainer and P-trap. Valve control to be lever.

P-3 WHEELCHAIR LAVATORY:

Vitreous china, FS WW-P-541/9, Type III, Class 2, Control A, 20 inches wide x 27 inches deep. With gooseneck spout.

Drain - Strainer shall be copper alloy or CRES.

P-4 KITCHEN SINK:

FS WW-P-541/5, ledge back with holes for faucet and spout single bowl 24 x 21 corrosion-resisting steel. Equal to Elkay Model DLR-2522-10.

Faucet and Spout - Cast or wrought copper alloy. Strainer shall have internal threads.

Handle - Cast copper alloy, wrought copper alloy, or CRES. Single lever type.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc. shall be copper alloy or CRES.

P-12 SERVICE SINK:

Enameled cast iron, copper alloy or CRES steel rim guard, FS WW-P-541/5 corner, floor mounted (28 inches square, 6-3/4 inches deep).

Faucet and Spout - Cast or wrought copper alloy, with top or bottom brace, with backflow preventer. Faucets shall have replaceable seat and the stem shall rotate onto the seat. Handles shall be lever type. Strainers shall have internal threads.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc. shall be copper alloy or CRES.

Trap - Cast iron.

P-5 DRINKING FOUNTAIN: HANDICAPPED, ELECTRIC REMOTE CHILLER

Push button type, ASME A112.19.2M or FS WW-P-541/6, surface wall mounted - corrosion-resisting steel. Round bowl, back height 45 inches. Equal to Halsey Taylor Model OVL-EBP.

Accessories including bubblers, stops, stream regulators, flow controls, pushbuttons and traps shall be copper zinc alloy. Automatic stream regulators or flow control shall be incorporated in the bubbler. Surface mounted fountains shall have concealed fasteners. Fountains shall have simple bubbler and shall be for interior installation. Self-closing valves shall have push button or cross-shaped index metal turn handle without hood. Drain outlet shall be suitable for the installation. Exposed surfaces of CRES shall have No. 4 general polish finish. Remote water chiller to provide 10.4 gph of 50-degree F water when supplied with 80 degree F inlet water. Equal to Halsey Taylor model SJ10A.

P-5A ELECTRICAL WATER COOLER: HANDICAPPED

Self-contained, wall hung, mechanically refrigerated drinking water coolers shall conform to ARI 1010, shall use one of the halogenated hydrocarbons as a refrigerant, and shall have a capacity to deliver a minimum of 8 gph of 50-degree F water when supplied with 80-degree F inlet water and a 90-degree F room temperature. Equal to Halsey Taylor OVL-ER.

P-9 WALL CLEAN OUT: J.R. Smith model 4100 series, cast iron body, bronze plug and round adjustable heavy duty nickel bronze scoriated top or approved equal. Same size as pipe in which installed.

P-8 TRAP PRIMER: J.R. Smith model 2699-1 bronze valve with vacuum breaker and 1/2" copper sweat fitting or approved equal.

P-9 WALL CLEANOUT (TEE): J.R. Smith No. 4530 series, cast iron, bronze plug with stainless steel shallow cover and screw or approved equal. Same size as pipe in which installed.

P-10 SURFACE CLEAN OUT: Wade W-8300-MF series with extra heavy access housing, adjustable anchor flange, extra heavy secured scoriated cast iron cover and W-8530/W-8540 cleanout ferrule with plug.

P-11 WATER HAMMER ARRESTER: Equal to J.R. Smith model 5020 for 33 to 60 fixture units. Arresters to be P.D.I. certified and provided access for easy service.

TABLE I

PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE					
Item No.	Pipe and Fitting Materials	A	B	C	D	E	F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets	X	X	X	X	X	
2	Cast iron soil pipe and fittings hubless, CISPI Std 301		X		X	X	
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 6		X		X	X	
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 6				X	X	
5	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 6				X	X	
6	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996						X

A - Underground Building Soil, Waste and Storm Drain
B - Aboveground Soil, Waste, Drain In Buildings
C - Underground Vent
D - Aboveground Vent
E - Interior Rainwater Conductors Aboveground
F - Corrosive Waste And Vent Above And Belowground
* - Hard Temper

TABLE II

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

		SERVICE			
Item No.	Pipe and Fitting Materials	A	B	C	D
1	Malleable-iron threaded fittings, galvanized, ASME B16.3 for use with Item 3	X	X	X	X
2	Grooved pipe couplings, ASTM A 36 and ASTM A 47	X	X	X	
3	Steel pipe:				
	a. Seamless, galvanized, ASTM A 53, Type S, Grade B	X	X	X	X
	b. Seamless, black, ASTM A 53, Type S, Grade B			X	
4	Seamless copper pipe, ASTM B 42	X	X		X
5	Seamless copper water tube, ASTM B 88	X*	X*	X**	X***
6	Seamless and welded copper distribution tube (Type D) ASTM B 641	X	X		X****
7	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 7 and 8	X	X	X	X
8	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Items 7 and 8	X	X	X	X
9	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D 2996	X	X		
10	Steel pipeline flanges, MSS SP-44	X	X		
11	Unions: brass or bronze, FS WW-U-516	X	X		

TABLE II. (Continued)

Item No.	Pipe and Fitting Materials	SERVICE A	B	C	D
12	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
13	Malleable-iron threaded pipe unions ASME B16.39	X	X		
14	Nipples, pipe threaded FS WW-N-351	X	X	X	

A - Cold Water Aboveground
B - Hot Water 180 F Maximum Aboveground
C - Compressed Air Nonoil-Free
D - Cold Water Service Belowground Indicated types are minimum wall thicknesses.
* - Type M - Hard
** - Type L - Hard
*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors
**** - In or under slab floors only brazed joints

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SECTION 15653

AIR-CONDITIONING SYSTEM (UNITARY TYPE)

PART 1 GENERAL

1.1 REFERENCES

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

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 210/240	(1989) Unitary Air-Conditioning and Air-Source Heat Pump Equipment

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 527	(1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
ASTM B 32	(1989) Solder Metal
ASTM B 75	(1986) Seamless Copper Tube
ASTM B 209	(1990) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 1071	(1986) Thermal and Acoustical Insulation (Mineral Fiber, Duct Lining Material)
ASTM E 84	(1991a) Surface Burning Characteristics of Building Materials

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

ASHRAE 15	(1989) Safety Code for Mechanical Refrigeration

FEDERAL SPECIFICATIONS (FS)

FS F-F-310	(Rev B) Filter, Air Conditioning: Viscous-Impingement and Dry Media, Replaceable
FS BB-F-1421	(Rev B) Fluorocarbon Refrigerants
FS RR-W-360	(Rev A) Wire Fabric, Industrial

MILITARY SPECIFICATIONS (MS)

MS MIL-A-3316	(Rev C; Am 2) Adhesives, Fire-Resistant, Thermal Insulation

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA)

SMACNA-03	(1979; 5th Ed) Fibrous Glass Duct Construction Standards
SMACNA-06	(1985; 1st Ed) HVAC Duct Construction Standards - Metal and Flexible

UNDERWRITERS LABORATORIES (UL)

UL 559	(Jun 18, 1985; 4th Ed; Rev thru. Dec 24, 1987) Heat Pumps
UL 900	(Jan 29, 1987; 5th Ed; Rev Mar 28, 1988) Test Performance of Air Filter Units

1.2 GENERAL REQUIREMENTS

The contract drawings indicate the extent and general arrangement of the air-conditioning system. Equipment, ductwork, and piping arrangements shall fit into space allotted and shall allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance.

1.2.1 Standard Products

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory use for at least 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 manufacturers' factory tests, can be shown. The equipment items shall be supported by a service organization.

1.2.2 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy, before performing any work.

1.2.3 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, serial and model numbers and catalog number on a plate securely attached to the item.

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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-04, Drawings

Air-Conditioning System; GA.

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the equipment and systems. Detail drawings for equipment, atmospheric cooling equipment, energy recovery devices, filters, pumps, controls, and associated appurtenances. Drawings shall include an electrical connection diagram for each piece of mechanical equipment having more than one automatic or manual electrical control device, distribution layout drawings for all suspended ductwork showing the location of all supports and hangers.

1.3.2 SD-09, Reports

Test Data; GA.

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

1.3.3 SD-13, Certificates

Materials and Equipment; GA.

Where materials or equipment are specified to comply with requirements of ARI, ASHRAE, or ASME, proof of such compliance. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted. As an alternative to the above requirements, the manufacturer may submit a standard computer product selection printout based on the manufacturer's certified test data. Manufacturer shall certify that the computer selected equipment meets the requirements of ARI or ASHRAE and will meet the capacity indicated on drawings. Where equipment is specified to conform to requirements of ASME, the design, fabrication, and installation shall conform to the code.

1.3.4 SD-19, Operation and Maintenance Manuals

Air-Conditioning System; GA.

Six (6) complete copies of operating instructions outlining the step-by-step procedures required for system startup, operation and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and its basic operating features. Six (6) complete

copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. The instructions shall include simplified wiring and control diagrams for the system as installed. At least one copy of the manufacturer's warranty shall also be included.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt, dust, or other contaminants.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Duct Liner

ASTM C 1071, Type I and II, except as otherwise noted; SMACNA-06.

2.1.2 Pipe and Tubing

a. Copper Tubing, Condensate Service: ASTM B 75, seamless copper tubing, Type K or L, hard drawn.

2.1.3 Refrigerant

FS BB-F-1421. All refrigerants used shall have an Ozone Depletion Potential of less than or equal to 0.05.

2.1.4 Screen, Bird

FS RR-W-360, Type 1, Class 1, 2 by 2 mesh, 0.063-inch diameter aluminum wire or 0.031-inch diameter stainless steel wire.

2.1.5 Sheet Metal

a. Aluminum Alloy: ASTM B 209, gauge numbers specified refer to Brown and Sharpe gauge.

b. Steel: ASTM A 527, gauge numbers specified refer to United States standard gauge.

2.1.6 Solder

a. Water Lines: ASTM B 32, Alloy Grade 50A.

2.2 HEAT PUMP, AIR-TO-AIR, PACKAGED UNIT

2.2.1 Type

Unit shall be single-package type, provided with specified or indicated functions and appurtenances, in accordance with ARI 210/240. Units shall provide heating and cooling functions as indicated.

2.2.2 Capacity and Performance Criteria

a. Energy Efficiency Ratio (EER): Unit shall produce an EER as 8.9, when rated in accordance with ARI 210/240.

b. Coefficient of Performance (COP): Unit shall produce a COP of not less than 8.4, when rated in accordance with ARI 210/240.

c. Performance Rating: Cooling [and heating] capacity of each unit shall meet the sensible and total heat requirements. Allowances shall be made for the effective sensible heat factor to satisfy the required sensible cooling capacity.

2.2.3 Fans

a. General: Fan wheel shafts shall be supported by either maintenance accessible lubricated antifriction block-type bearings, or permanently lubricated ball bearings. Unit fans shall be selected to produce the capacity required at the fan total pressure. Fan performance curves for the unit fans shall be furnished to the Contracting Officer at the time the Contractor submits his proposed testing program. Fan motors shall have open enclosure. Motor starters shall be magnetic across-the-line type with a general purpose enclosure. Thermal overload protection shall be of the automatic reset type. All fan wheels or propellers shall be constructed of aluminum or galvanized steel. Centrifugal fan wheel housings shall be of galvanized steel, and both centrifugal and propeller fan casings shall be constructed of aluminum or galvanized steel. All steel elements of fans, except fan shafts, shall be hot-dipped galvanized after fabrication or fabricated of mill galvanized steel. Mill galvanized steel surfaces and edges damaged or cut during fabrication by forming, punching, drilling, welding or cutting shall be recoated with an approved zinc-rich compound. Fan wheels or propellers shall be dynamically balanced after fabrication and the application of any specified protective coatings

b. Supply Air Fans: Fans shall be forward curved type and shall be provided in each air-discharge opening of the fan section. Fans shall be indirectly connected to the motor by means of a V-belt drive. Belt-driven fans shall have adjustable sheaves to provide not less than 20 percent fan-speed adjustment. The sheave size shall be selected so that the fan speed at the approximate midpoint of the sheave adjustment will produce the specified air quantity.

2.2.4 Condensing Section

a. Compressors: Compressors shall be direct drive, semihermetic or hermetic reciprocating, or scroll type as specified. If standard with the manufacturer, two or more compressors may be used, in which case the compressors will operate in sequence. Each compressor shall be provided with vibration isolators, crankcase heater, lubrication pump, thermal overloads, and high, low pressure safety cutoffs and protection against short cycling.

b. Reversible Function Coils: Units shall have nonferrous tubes of 3/8-inch minimum diameter with aluminum fins that are mechanically bonded or soldered to the tubes. Casing shall be galvanized steel or aluminum. Contact of dissimilar metals shall be avoided. Coils shall be tested in accordance with ASHRAE 15 at the factory and shall be suitable for the working pressure of the installed system. Each coil shall be dehydrated and sealed after testing and prior to evaluation and charging.

Each unit shall be provided with a factory operating charge of refrigerant and oil or a holding charge. Units shipped with a holding charge shall be field charged. Separate expansion devices shall be provided for each compressor circuit, and a filter-drier shall be installed in each liquid refrigerant line circuit. Unit shall be provided with subcooling circuit which shall ensure proper liquid refrigerant flow to the expansion device over the specified application range of the condenser.

c. Refrigeration Circuit: Refrigerant flow control devices shall be an adjustable superheat thermostatic expansion valve with external equalizer matched to coil, capillary or thermostatic control pilot solenoid controlled, leak-tight, four-way refrigerant flow-reversing valve with NEMA Class F solenoid coil. Filter drier shall be provided in each liquid line and shall be reversible-flow type. High and low pressure switches shall be provided.

2.2.5 Air Filters

Air filter shall be in accordance with requirements of UL 900.

a. Disposable Type: Filters shall be disposable, nominal 2-inches thick and shall conform to FS F-F-310, and UL 900, Class 2.

2.2.6 Dampers

Damper provisions shall include 25 percent outside air.

2.2.7 Internal Controls

Unit shall be internally prewired with a 24-volt control circuit powered by an internal transformer. Terminal blocks shall be provided for power wiring and external control wiring. Unit shall have cutoffs for: high and low pressure, low oil pressure, or supply fan failure. Units shall have safety interlocks on all service panels. Head pressure controls shall sustain unit operation with an ambient temperature of 0 degrees F. Adjustable-cycle timers shall prevent short cycling and multiple compressors shall be staged by means of a time delay. Unit shall be internally protected by fuses or a circuit breaker, in accordance with UL 559. For unit controls located outside the unit cabinets see paragraph: TEMPERATURE CONTROLS.

2.2.8 Cabinets

2.2.8.1 Outdoor Cabinet Materials and Construction

Cabinets shall be suitable for outdoor service with a weathertight, insulated and corrosion-protected structure complete with roof curb. Cabinets constructed exclusively for indoor service which have been modified for outdoor service are not acceptable. Casing shall be constructed with galvanized or aluminum sheet metal and galvanized or aluminum structural members. Minimum thickness of single wall exterior surfaces shall be 20-gauge galvanized steel or .064-inch thick aluminum on units with a capacity less than 20 tons. Where double-wall insulated construction is proposed, minimum exterior galvanized sheet metal thickness shall be 20 gauge. Provisions to permit replacement of major unit components shall be incorporated. Penetrations of cabinet surfaces, including the floor, shall be sealed. Unit shall be fitted with a drain pan which extends under all areas where water may accumulate. Drain pan shall be fabricated from Type 300 stainless steel or galvanized steel with protective

coating as required. Pan insulation shall be water impervious. Extent and effectiveness of the insulation of unit air containment surfaces shall prevent, within limits of the specified insulation, heat transfer between the unit exterior and ambient air, heat transfer between the two conditioned air streams, and condensation on unit surfaces. Insulation shall conform to ASTM C 1071.

2.3 SHEET-METAL DUCTWORK

2.3.1 Sheet Metal

2.3.1.1 General

Ductwork shall be constructed of galvanized steel sheets or of aluminum sheets and in accordance with SMACNA-06. Ducts, unless otherwise approved, shall conform to the dimensions indicated and shall be straight and smooth on the inside, with joints neatly finished. All edges and slips shall be hammered down to leave a smooth interior duct finish. All ductwork shall be substantially airtight with no audible leaks in high pressure systems. No dust marks from air leaks shall show at connections, grilles, registers or diffusers. Ducts shall be free from vibration under all conditions of operation. All duct joints shall be in accordance with SMACNA-06. Where supports are required between structural framing members, suitable intermediate metal framing shall be provided. Square elbows shall be provided with double wall turning vanes. Items not shown or specified shall be as required in SMACNA-06.

2.3.1.2 Low Velocity Ducts and Stiffeners

Low velocity ducts and stiffeners shall be constructed of thickness and fabrication specified in TABLES I and II for round ducts and as specified in SMACNA-06.

TABLE I. SHEET METAL THICKNESS FOR SPIRAL LOCK SEAM ROUND DUCT CONSTRUCTION, LOW VELOCITY SYSTEMS

Aluminum Sheet; B&S Gauge and Thickness, Inch	Aluminum Fittings; B&S Gauge and Thickness, Inch	Duct; Diameter, Inch
22 0.025	16 0.051	Up thru 8
20 0.032	16 0.051	9 thru 22
18 0.040	16 0.051	23 thru 36

NOTES: All fittings shall be continuous weld construction. Ducts exceeding 36 inches in diameter shall be rounded ducts conforming to TABLE II.

TABLE II. SHEET METAL THICKNESS FOR BUTT WELD OR LOCK TYPE LONGITUDINAL SEAM ROUND DUCT CONSTRUCTION, LOW VELOCITY SYSTEMS

Aluminum Sheet B&S Gauge and Thickness	Aluminum Fittings; B&S Gauge and Thickness, Inch	Duct; Diameter, Inch	Bracing; Inches
22 0.025	16 0.051	Up thru 10	
20 0.032	16 0.051	11 thru 20	
18 0.040	16 0.051	21 thru 36	1-1/4 by 1-1/4 by 1/8 girth angle reinforcing spaced on 8-foot max centers

2.3.1.3 Splitters and Dampers

Dampers shall have accessible operating mechanisms, and where operators occur in finished portions of the building, operators shall be chromium plated with all exposed edges rounded. Splitter dampers 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 12 inches. Manual volume-control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be two gauges heavier than the duct in which installed. 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. 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 a standard accessory of the damper manufacturer. Volume dampers shall be provided where indicated.

2.3.1.4 Air Extractors

Air extractors shall be provided in all duct-mounted supply outlets, take off or extension collars to supply outlets, and tap-in branch-take-off connections. Air extractors shall be factory fabricated and factory or field assembled units consisting of adjustable curved turning vanes or louver blades for uniform air distribution and change of direction with minimum turbulence and pressure loss. Inaccessible extractors shall be provided with means for adjustment and position lock external to the duct.

2.3.1.5 Hinged Duct-Access Doors

Hinged duct-access doors shall be provided at all air control dampers, fire dampers, and all other apparatus requiring service and inspection in the duct system. Access doors shall be minimum 15 by 18 inches unless otherwise indicated. Where size of duct will not accommodate this size, the door shall be made as large as practicable. Gasketed access doors of rigid type, not less than 24 by 24 inches, shall be provided on the inlet and outlet sides of each air-handling unit. Doors shall be provided with galvanized steel hinges having bronze pins and brass fasteners. All doors 24 by 24 inches and over shall be provided with fasteners that can be operated from both sides. Access doors in plenums and ducts with acoustical lining shall be provided with the same type lining. Leakage around access doors shall be limited to 5 percent or less of the design flow.

2.3.1.6 Apparatus Connections

Where sheet metal connections are made to fans or where ducts of dissimilar metals are connected, a noncombustible flexible connection approximately 6 inches in width shall be installed and securely fastened by zinc coated steel, clinch type draw bands for round ducts. For rectangular ducts the flexible connections locked to metal collars shall be installed using normal duct construction methods.

2.3.1.7 Duct Sleeves and Prepared Openings

Duct sleeves shall be provided for round ducts 15 inches or less in diameter passing through floors, walls, ceilings, or roofs. Round ducts larger than 15 inches in diameter and all square and rectangular ducts passing through floors, ceilings, or roofs shall be installed through prepared openings. The Contractor shall be responsible for the proper size and location of sleeves and openings. Duct sleeves and prepared openings shall be provided for all duct mains and duct branches. Branch take-off connections to grilles, registers, and diffusers shall be in accordance with SMACNA-06.

2.3.1.8 Duct Sleeves

Duct sleeves shall be fabricated from 20-gauge, galvanized steel, unless otherwise indicated. Where sleeves are installed in bearing walls or partitions, black steel pipe, or standard weighted pipes shall be used. Sleeves shall provide 1-inch clearance between the duct and the sleeve except at grilles, registers, and diffusers.

2.3.1.9 Prepared Openings

Prepared openings for round ducts larger than 15-inches diameter and for all square and rectangular ducts shall provide 1-inch clearance between the duct and the opening except at grilles, registers, and diffusers.

2.3.1.10 Closure Collar

Closure collar of galvanized steel not less than 4 inches wide shall be provided on each side of walls or floors where sleeves or prepared openings are provided except where grilles, registers or diffusers are installed. Collars for round ducts

15 inches in diameter or less shall be fabricated from 20-gauge galvanized steel. Collars for round, square or rectangular ducts with minimum dimension over 15 inches shall be fabricated from 18-gauge galvanized steel.

2.3.1.11 Duct Supports

Duct supports shall be constructed in accordance with details on the drawings and whenever it may be structurally advantageous to support the entire duct system. For 24-inch and larger rectangular ducts, suspension shall consist of horizontal tees or angles supported by vertical straps, rods or wires as recommended by SMACNA-03.

2.4 DIFFUSERS, REGISTERS, GRILLES

a. General: Diffusers, registers, and grilles shall be field fabricated steel or aluminum as detailed on the drawings.

2.5 TEMPERATURE CONTROLS

2.5.1 General

Temperature controls shall be solid-state electronic, type, that will provide the required sequence of operation control.

2.5.2 Function Controls

Station shall include:

a. Programmable operating system.

b. Operating mode thermostats with adjustable heat and adjustable cooling anticipation with indicated stages of heating and cooling.

c. Status of Function lights for supply fan operation, heating and cooling system malfunction, and refrigerant compressor malfunction.

d. Night set-back with 24-hour clock, multiple day skip-a-day feature, and manual override.

2.6 ACOUSTICAL DUCT LINING

a. General: Acoustical duct lining shall be fibrous glass designed exclusively for lining duct and shall conform to the requirements of ASTM C 1071, Type I or Type II, except as specified. The lining composition may be uniform-density, graduated-density or dual-density, coated or uncoated, standard with the manufacturer. Lining shall be not less than 1-inch thick, nominal. Lining shall conform to the fire hazard rating specified in ASTM E 84. Duct sizes shown shall be increased to compensate for the thickness of the lining used. Acoustical liner shall be provided where indicated and to the extent shown. Fire resistance adhesive for applying to duct shall conform to MS MIL-A-3316, Class 1 as specified.

b. Application: The lining shall be applied in cut-to-size pieces attached to the interior of the duct with Class 2 fire resistant adhesive. Top and bottom pieces shall lap the side piece and in addition shall be secured with welded pins, adhered

clips, metal, nylon or high impact plastic, and speed washers or welding cup-head pins on maximum 12-inch centers. Welded pins, cup-head pins or adhered clips shall not distort the duct, burn through or mar the finish or the surface of the duct. Pins and washers shall be flush with the surface of the duct liner, and all breaks and punctures of the duct liner coating shall be sealed with Class 1 fire resistant adhesive. All exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of Class 1 fire-resistant adhesive, to prevent delamination of the glass fibers. The duct liner may also be applied to flat sheet metal with Class 2 fire-resistant adhesive, prior to forming duct through the sheet metal brake. The lining at the top and bottom surfaces of the duct shall be additionally secured by welded pins or adhered clips 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.

c. Preformed Round Duct Liner: Preformed round duct liner of the thickness specified and designed for insertion in round ducts of a low-velocity system may be used in the sizes commercially available. The duct liner sections shall be furnished with not less than 2 inches wide shiplap joints. Joints shall be made up in accordance with the printed instructions of the manufacturer. When recommended by the manufacturer of the liner, fire resistant adhesives shall be used to field coat all joints, to prevent delamination or erosion. The tubular sections of the duct liner shall fit the metal duct snugly and without gaps between duct liner sections.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

Refrigeration equipment and the installation thereof shall conform to ASHRAE 15. Necessary supports shall be provided for equipment, appurtenances, pipe, and ductwork as required; these include frames or supports for air conditioners, condensers, fans, coils, dampers, and other similar items requiring supports. Unless otherwise indicated, all equipment shall be installed in accordance with the manufacturer's recommendations.

3.2 CLEANING AND PRESSURE TESTING

3.2.1 Cleaning

Ducts, plenums, and casings shall be thoroughly cleaned of all debris and blown free of all small particles of rubbish and dust before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and after all construction dirt has been removed from the building, new filters shall be installed. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer.

3.3 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting and balancing shall be as specified in SECTION: TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

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SECTION 15935

VENTILATION AND EXHAUST 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 210	(1985) Laboratory Methods of Testing Fans for Rating
AMCA 300	(1985; Rev 1987) Reverberant Room Method for Sound Testing of Fans

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36	(1991) Structural Steel
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 167	(1991) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 366	(1991) Steel, Sheet, Carbon, Cold-Rolled Commercial Quality
ASTM A 525	(1991b) General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 527	(1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
ASTM A 528	(1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Drawing Quality
ASTM A 569	(1991a) Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality
ASTM A 642	(1990) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Drawing Quality, Special Killed

FEDERAL SPECIFICATIONS (FS)

FS RR-W-360	(Rev A) Wire Fabric, Industrial

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(1987; Rev 1) Motors and Generators

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA-06	(1985; 1st Ed) HVAC Duct Construction Standards - Metal and Flexible
SMACNA-10	(1985; 1st Ed) HVAC Air Duct Leakage Test Manual

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products, which are of a similar material, design, and workmanship. The standard products shall have been in a satisfactory commercial or industrial use for 2 years prior to 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 6,000 hours exclusive of the manufacturers' 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 their qualifications. These service organizations shall be reasonably convenient to the equipment on a regular and emergency basis during the warranty period of the contract.

1.2.2 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.

1.2.3 Equipment Guards and Access

Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts so located that personnel can come in close proximity thereto, shall be fully enclosed or properly guarded.

1.2.4 Nameplates

Each major item of equipment shall have the manufacturer's name, address, and serial and model number on a plate securely attached to the item.

1.2.5 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural, and finish conditions that would affect the work to be performed and shall arrange such work accordingly, furnishing required ductwork offsets, fittings, and accessories to meet such conditions.

1.2.6 Asbestos Prohibition

Asbestos and asbestos-containing products shall not be used.

1.3 SUBMITTALS

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

1.3.1 SD-01, Data

Ventilation and Exhaust System; GA.

Illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of the equipment and the system.

1.3.2 SD-19, Operation and Maintenance Manuals

Ventilation and Exhaust System; GA.

Two (2) complete copies of instructions outlining the step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Two (2) complete copies of maintenance manuals listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The instructions shall include simplified wiring and control diagrams for the system as installed.

1.4 ELECTRICAL WORK

Electrical motor-driven equipment specified herein shall be provided complete with motor starters, motor, and controls. Electrical equipment, conduits, and wiring shall be in accordance with SECTION: ELECTRICAL WORK, INTERIOR. Manual or automatic control and protective or signal devices required for the operation specified, and any wiring required for such devices shall be provided.

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, and other contaminants.

PART 2 PRODUCTS

2.1 AIR MOVING DEVICES

2.1.1 General Fan and Motor Requirements

Fans shall be tested and rated in accordance with AMCA 210. Fans may be connected to the motors either directly or indirectly with V-belt drives. V-belt drives shall be designed for not less than 120 percent of the connected driving capacity. Motor sheaves shall be variable pitch for 15 Hp and below. Variable pitch sheaves shall be selected to drive the fan at such speed as to 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. Fan 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. Vibration-isolation units shall be standard products with published loading ratings, and shall be single rubber-in-shear, double rubber-in-shear, springs, or springs under inertial base, unless otherwise indicated. Each fan shall be selected to produce the capacity required at the fan total pressure indicated. Sound power level dB referenced to 10 to the minus twelfth power watt, mid-frequency, shall not exceed the value or values for the octave band or bands shown for each fan. Fan performance curve for each fan shall be submitted at the time the proposed testing program is submitted. Sound power data for each fan in all octave bands at mid-frequencies shall be submitted. The sound power level values shall be obtained in accordance with AMCA 300. Standard AMCA arrangement, rotation, and discharge shall be as indicated.

2.1.2 Centrifugal Fans

2.1.2.1 In-Line Centrifugal Fans (EF-1, EF-2, and EF-3 on drawings)

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 weld tubular casing. Air shall enter and leave the fan axially. Inlets shall be streamlined with conversion vanes to eliminate turbulence and provide smooth discharge airflow. 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. Bearings shall be precision self-aligning ball or roller type with L50 bearing life rated at not less than 200,000 hours of operation. Motors shall have dripproof and explosion-proof enclosure. Motor starters shall be manual. Remote manual switch with pilot indicating light shall be provided where indicated. Fans shall be AMCA Pressure Class I, II, or III as required or indicated for the system design pressure.

2.2 DUCTWORK AND ACCESSORIES

2.2.1 Sheet Metal Ductwork

Ductwork shall be constructed of galvanized steel or aluminum sheets. Unless otherwise indicated or specified, sheet metal ductwork shall comply with SMACNA-06. Ductwork shall conform accurately to the dimensions indicated. Button punch or bolt connections in standing seams shall be spaced at not greater than 6 inches on centers. Longitudinal locks or seams termed "Button Punch Snap Lock" are acceptable in lieu of Pittsburgh locks on galvanized steel ductwork for duct pressure classifications of 2-inches water gage pressure or less. Wherever practicable, elbows shall be radius type with a centerline radius of 1-1/2 times the width or diameter of the duct. Where space does not permit, the use of short radius elbows having a minimum radius of 1.0 times the width or diameter of the duct, or square elbows with factory fabricated turning vanes may be used.

2.2.1.1 Transitions

Diverging air flow transitions shall be made with each side pitched out a maximum of 20 degrees, for an included angle of 40 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.

2.2.1.2 Fittings

Square elbows, fittings, and branch take-offs shall be designed and constructed as specified in SMACNA-06. Rectangular mitered fittings shall contain turning vanes.

2.3 MISCELLANEOUS MATERIALS AND EQUIPMENT

Miscellaneous materials and equipment shall conform to the following:

2.3.1 Iron and Steel Sheets

2.3.1.1 Corrosion Resistant Sheets

ASTM A 167, Type 304 or Type 316, Finish 1. Gauge numbers refer to United States Standard Gauge.

2.3.1.2 Galvanized Sheets

ASTM A 527, ASTM A 528, or ASTM A 642, with general requirements conforming to ASTM A 525. Gauge numbers refer to Manufacturer's Standard Gauge.

2.3.1.3 Uncoated Sheets

ASTM A 366 or ASTM A 569. Gauge numbers refer to United States Standard Gauge.

2.3.1.4 Galvanized Steel Shapes

ASTM A 36, galvanized in accordance with ASTM A 123 to a commercial coated weight of not less than 2.3 ounces per square foot of single side surface.

2.3.1.5 Uncoated Carbon Steel Plates and Shapes

ASTM A 36.

2.3.1.6 Stainless Steel

ASTM A 167, Types 302, 304L or 316L with mill finish, except as otherwise specified.

2.3.1.7 Coated Galvanized Steel Sheet

ASTM A 525 coating Class G-60, lock forming quality steel sheet, roll coated internally with 4 mil dry film thickness, fusion bonded, polyvinyl chloride (PVC) plastisol resin and externally with one mil dry film thickness epoxy washcoat primer externally with one mil dry film thickness, fusion bonded, polyvinyl chloride (PVC) plastisol resin. PVC coating shall be tested for flaws with a 90-volt, wet sponge pin hole detector.

2.3.2 Motors

2.3.2.1 Fractional Horsepower

Motors shall conform to NEMA MG 1. Single and polyphase motors shall be induction type, squirrel cage or wound rotor style. Shaded pole motors shall not be used. All motors shall be continuous duty and with enclosure as specified or shown.

2.3.2.2 Bird Screen

FS RR-W-360, Type I, Class 1, 2 by 2 mesh, 0.063-inch diameter aluminum wire or 0.031-inch diameter stainless steel wire.

2.3.2.3 Frames

Removable type of extruded aluminum or stainless steel. Inspect screen frames shall be grooved type with vinyl or neoprene spline insert for securing screen cloth.

2.4 PAINTING AND FINISHING

Equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except the items located outside of buildings shall have weather-resistant finishes.

PART 3 EXECUTION

3.1 INSTALLATION

Materials and equipment shall be installed and prepared for service as indicated and as recommended by the manufacturer. Temporary air filters shall be provided for systems that are operated during the construction phase of the project.

3.2 DUCT LEAKAGE TESTING

All sheetmetal ductwork that is designed to operate at static pressures above 3 inch water gauge shall be leak tested in accordance with SMACNA-10 at a test pressure equal to the duct pressure classification. The duct leakage shall be less than or equal to the allowable CFM duct leakage per 100 square feet per the appropriate leakage class in section 4 of SMACNA-10. Test reports shall be provided in accordance with section 6 of SMACNA-10.

3.3 TESTING, ADJUSTING, AND BALANCING

Testing, adjusting, and balancing shall be as specified in SECTION: TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

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SECTION 15990

TESTING, ADJUSTING AND BALANCING OF HVAC SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1	(1989; 5th Ed) National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems

1.2 GENERAL REQUIREMENTS

The Contractor shall use AABC MN-1 as the standard for providing testing, adjusting and balancing of air and water systems. The standard shall be used throughout the project. Testing, adjusting, and balancing shall be accomplished by a firm certified for testing and balancing by Associated Air Balance Council (AABC). Prior to testing, adjusting, and balancing, the Contractor shall verify that the systems have been installed and are operating as specified. Approved detail drawings and all other data required for each system and/or component to be tested shall be made available at the jobsite during the entire testing, adjusting and balancing effort. The Contractor shall verify that all balancing devices are properly installed to permit testing, adjusting and balancing and that all duct leakage tests have been completed prior to testing, adjusting and balancing. The Contracting Officer shall be notified in writing of all equipment, components, or balancing devices, that are damaged, incorrectly installed, or missing, as well as any design deficiencies that will prevent proper testing, adjusting, and balancing. Testing, adjusting, and balancing shall not commence until approved by the Contracting Officer. Instrumentation accuracy shall be in accordance with the standard selected in this paragraph.

1.3 INSTRUMENT ACCURACY REQUIREMENTS

All instrumentation shall be checked for accuracy before beginning testing, adjusting and balancing procedures. Instrument accuracy shall be in accordance with the standard selected in paragraph: GENERAL REQUIREMENTS. Checks may be carried out against similar equipment maintained specifically for checking purposes or by the manufacturer or a recognized testing facility. All instrumentation used for testing shall be calibrated within 6 months of use. Pitot tubes and U-tube manometers do not require checking. In no case shall the instrumentation accuracy be less than specified by the instrument manufacturer. Any instrument falling out of calibration during the process of balancing and testing shall be recalibrated or removed from the site and replaced by a properly calibrated instrument. No instruments shall be allowed to remain on-site that are not in calibration.

1.4 SUBMITTALS

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

1.4.1 SD-09, Reports

Testing and Balancing; GA.

Three copies of a preliminary report, 30 days before balancing commences. The report shall be organized by specific systems and shall clearly identify each item of equipment to be tested, adjusted, and balanced. The appropriate test procedures and measurements to be taken for each item of equipment shall be listed. Instrument calibration records shall be provided on forms shown in AABC MN-1. Manufacturer's specified accuracy shall be shown. The report shall include floor plans showing all measurement locations and types of measurements to be made. All related data necessary for testing, balancing, and adjusting, including fan curves and pump curves, shall be included. A system readiness checklist shall be included. The report shall contain a listing of the deficiencies of all systems to be tested, adjusted and balanced and the corrective action taken. The report shall contain a schedule for the testing and balancing. Six (6) copies of the final report on forms shown in AABC MN-1 shall be provided within 30 days after completion of the test and balance operation. Data shall be in a hard bound cover identifying the project name, location, date of submittal, name of Contractor, and a general title indicating the specific area and type of work, and shall be signed by a registered professional engineer, employed by the test and balance firm, who has a minimum of 2 years experience in testing, adjusting and balancing work. The final report shall include a summary describing test methods, test results, and major corrective actions taken. The report shall include as-tested floor plans showing all measurement locations and types of measurements made. The air handling unit data shall include a static pressure profile diagram, and pitot tube traverses where possible. Air distribution data shall include coded drawings which show the exact location of each air outlet.

All instruments that are recalibrated and brought back onto the jobsite after being found to be out of calibration shall have recalibration records submitted on forms shown in AABC MN-1.

1.4.2 SD-13, Certificates

Qualification; FIO.

Qualification data, 90 days prior to testing and balancing operations. The test and balance firm shall be certified by the Associated Air Balance Council (AABC). The lead balancing technician shall be qualified by AABC and his qualification data shall include past experience on at least five similar projects.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 TESTING AND BALANCING

3.1.1 General

The facility shall be essentially complete with final ceiling, walls, windows, doors and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems shall be complete and operable with balancing dampers, ducting, diffusers, returns, and control components in place. Exhaust fans and fume hoods shall be operational. All measurements and adjustments shall be made using procedures described in standard selected in paragraph: GENERAL REQUIREMENTS. Air motion and distribution from air terminals shall be as shown. Smoke tests may be used to demonstrate proper air distribution from air terminals. All data including deficiencies encountered and corrective action taken shall be recorded. If a system cannot be adjusted to meet the design requirements, the Contractor shall promptly notify the Contracting Officer in writing.

3.1.2 Air Systems

Clean filters shall be installed at the beginning of the testing, adjusting, and balancing effort. Each system shall be adjusted until all flow quantities are within plus ten percent and minus zero percent. Dampers shall be checked for tight shutoff. Air leakage around dampers shall be verified. Fans shall be checked for correct direction of rotation and proper speed shall be verified.

3.1.2.1 General Balancing Methods

In addition to the requirements for specific systems, flows in supply, exhaust and return air systems shall be balanced using the methods in standard selected in paragraph: GENERAL REQUIREMENTS. Air flow adjustments shall be made by first adjusting the fan speed to meet the design flow conditions. Fan speed adjustment may not be required for fan motors which are less than one horsepower, or if throttling results in no greater than an additional 1/3 horsepower draw above that required if the fan speed were adjusted. Flows and pressures shall be checked in all main risers and supply ducts at all supply, exhaust and return fan discharges. All flows shall be recorded before and after each adjustment.

3.1.2.2 Specific Systems

All special or additional procedures for testing and balancing shall be in accordance with the applicable requirements of the standard selected in paragraph: GENERAL REQUIREMENTS.

3.1.3 Marking of Setting

Following final acceptance of certified reports by the Contracting Officer, the setting of all HVAC adjustment devices including valves, splitters, and dampers shall be permanently marked by the testing and balancing engineer so that adjustment can be restored if disturbed at any time.

3.1.4 Marking of Test Ports

The testing and balancing engineer shall permanently and legibly mark and identify the location points of the duct test ports. If the ductwork has exterior insulation, these markings shall be made on the exterior side of the ductwork insulation. All penetrations through ductwork and ductwork insulation shall be properly sealed to prevent air leakage or loss of vapor barrier.

3.2 CONTROL SYSTEMS

Testing, adjusting, and balancing of the systems shall be coordinated with the control system installation. All control components shall be verified to be properly installed and operating as specified before proceeding with testing, adjusting, and balancing. Verification shall be in accordance with AABC MN-1.

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SECTION 16415

ELECTRICAL WORK, INTERIOR

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C82.1	(1985; C82.1a; C82.1b; C82.1c) Ballasts for Fluorescent Lamps
ANSI C82.4	(1985; C82.4a) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple Supply Type)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.20.1	(1987) Metal-Enclosed Low-Voltage Power Circuit-Breaker Switchgear
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 AB 1	(1986; Rev 1) Molded Case Circuit Breakers and Molded Case Switches
NEMA FU 1	(1986) Low Voltage Cartridge Fuses
NEMA ICS 1	(1988; Rev 1 & 2) Industrial Controls and Systems
NEMA ICS 2	(1988; Rev 1) Industrial Control Devices, Controllers and Assemblies
NEMA ICS 3	(1988; Rev 1) Industrial Systems
NEMA ICS 6	(1988; Rev 1) Enclosures for Industrial Control and Systems

NEMA LE 4	(1987) Recessed Luminaires, Ceiling Compatibility
NEMA MG 1	(1987; Rev 1) Motors and Generators
NEMA MG 10	(1983; R 1988) 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 PB 1	(1990; PB 1.1) Panelboards
NEMA PB 2	(1989; PB 2.1) Deadfront Distribution Switchboards
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	(1986) Electrical Nonmetallic Tubing (ENT)
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	(1990) National Electrical Code
NFPA 101	(1991) Safety to Life from Fire in Buildings and Structures

UNDERWRITERS LABORATORIES (UL)

UL-03	(1991; Supple) Electrical Construction Materials Directory
UL 1	(1985; Rev Jan 1992) Flexible Metal Conduit
UL 5	(1985; Rev thru Sep 1990) Surface Metal Raceways and Fittings
UL 6	(1981; Rev thru Jul 1991) Rigid Metal Conduit

UL 20	(1986; Rev thru Jul 1991) General-Use Snap Switches
UL 44	(1991; Rev Oct 1991) Rubber-Insulated Wires and Cables
UL 50	(1988; Rev thru Mar 1991) Cabinets and Boxes
UL 67	(1988; Rev thru Jul 1991) Panelboards
UL 83	(1991; Rev Sep 1991) Thermoplastic-Insulated Wires and Cables
UL 98	(1987; Rev thru Apr 1990) Enclosed and Dead-Front Switches
UL 198C	(1986; Rev thru Jun 1990) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198D	(1988; Rev Jul 1988) High-Interrupting-Capacity Class K Fuses
UL 198E	(1988; Rev Jul 1988) Class R Fuses
UL 198G	(1988; Rev May 1988) Fuses for Supplementary Overcurrent Protection
UL 360	(1986; Rev thru Feb 1990) Liquid-Tight Flexible Steel Conduit
UL 467	(1984; Rev thru Nov 1986) Grounding and Bonding Equipment
UL 486A	(1991; Rev Oct 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1991; Rev Oct 1991) Wire Connectors for Use with Aluminum Conductors
UL 489	(1991; Rev thru May 1992) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures
UL 506	(1989; Rev Jan 1990) Specialty Transformers
UL 508	(1989; Rev thru Jan 1992) Industrial Control Equipment
UL 510	(1986; Rev Oct 1986) Insulating Tape

UL 512	(1987) Fuseholders
UL 514A	(1991) Metallic Outlet Boxes
UL 514B	(1989; Rev thru Aug 1990; Errata Aug 1991) Fittings for Conduit and Outlet Boxes
UL 542	(1985; Rev thru Apr 1991) Lampholders, Starters, and Starter Holders for Fluorescent Lamps
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 797	(1983; Rev thru Jul 1991) Electrical Metallic Tubing
UL 869A	(1987; Rev thru Nov 1990) Reference Standard for Service Equipment
UL 891	(1984; Rev thru Jun 1991) Dead-Front Switchboards
UL 924	(1990; Rev thru Dec 1991) Emergency Lighting and Power Equipment
UL 935	(1984; Rev thru Dec 1991) Fluorescent-Lamp Ballasts
UL 943	(1985; Rev May 1990) Ground-Fault Circuit Interrupters
UL 1004	(1989; Rev Nov 1989) Electric Motors
UL 1029	(1986; Rev thru Nov 1991) High-Intensity-Discharge Lamp Ballasts
UL 1242	(1983; Rev thru Jun 1991) Intermediate Metal Conduit
UL 1570	(1988; Rev thru Oct 1991) Fluorescent Lighting Fixtures
UL 1571	(1991; Rev Jan 1992) Incandescent Lighting Fixtures
UL 1572	(1991) High Intensity Discharge Lighting Fixtures

UL 1660	(1987) Liquid-Tight Flexible Nonmetallic Conduit

1.2 GENERAL

Furnish and install all electrical equipment as indicated on the contract drawings and in accordance with this specification.

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 Electrical Contractor shall coordinate the electrical work with HVAC and electrical drawings and provide all power related wiring even if they are not shown on the electrical drawings.

1.2.3 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.

1.2.4 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, all identification nameplates shall be made of laminated plastic in accordance with FS L-P-387 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws, except m tors, 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 following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 1/4-Inch High Letters
Panelboards
Starters
Safety Switches
Motor Control Centers
Transformers
Equipment Enclosures
Switchgear
Switchboards
Motors

Each panel, section, or unit in motor control centers, switchgear or similar assemblies shall be provided with an additional nameplate which shall be provided for individual compartments in the respective assembly, including nameplates which identify "future," "spare," and "dedicated" or "equipped spaces."

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: SUBMITTAL DESCRIPTIONS.

1.3.1 SD-04, Drawings

Electrical Work; GA.

Detail drawings for all materials and equipment specified. Detail drawings shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical data; catalog cuts; and any special installation instructions that may be required. Drawings shall show applicable schematic diagrams. Two sets of as-built drawings, within 30 days following the project completion or turnover.

1.3.2 SD-09, Reports

Materials and Equipment; GA.

The label or listing of the Underwriters Laboratories, Inc., shall 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.

1.4 WORKMANSHIP

Materials and equipment shall be installed in accordance with recommendations of the manufacturer and as shown.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment 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.

2.1.1 Cables and Wires

Conductors in cables shall be annealed copper, except that AA-8000 series aluminum conductors may be used as an equivalent for copper conductors of No. 6 AWG or larger. Intermixing of copper and aluminum conductors in these sizes is not permitted. Design is based on copper conductors and aluminum conductors shall have an ampacity not less than that of the indicated copper conductors. Cables shall be single-conductor type, unless otherwise indicated. Cables and wires shall conform to UL 44 for rubber-insulated type; UL 83 for the thermoplastic-insulated type.

2.1.2 Cabinets for Communications

UL 50. Cabinets shall have boxes constructed of zinc-coated sheet steel. Cabinets shall be constructed with interior dimensions not less than those indicated. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum-size openings to the box interiors. Boxes shall be provided with a 5/8-inch plywood back board having a two-coat insulating varnish finish.

2.1.3 Circuit Breakers

Circuit breakers shall have voltage, current and interrupting ratings as indicated. Fully rated circuit breakers shall be provided to obtain the specified interrupting rating.

2.1.3.1 Molded-Case Circuit Breakers

NEMA AB 1 and UL 489 for circuit breakers.

a. Molded-Case Circuit Breakers: Single-pole breakers shall be full module size; two poles shall not be installed in a single module. Multipole breakers shall be of the common-trip type having a single operating handle, but for sizes of 100 amperes or less may consist of single-pole breakers permanently factory assembled into a multipole unit having an internal, mechanical, nontamperable common-trip mechanism and external handle ties. Breakers coordinated with current-limiting fuses shall have a combined interrupting capacity of 100,000 symmetrical amperes. All poles of associated breakers shall open if any fuse blows.

2.1.3.2 Ground Fault Circuit Interrupters

UL 943. Breakers equipped with ground fault interrupters shall have ground fault class, interrupting capacity, and voltage and current ratings as indicated.

2.1.4 Conduit and Tubing

2.1.4.1 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797.

2.1.4.2 Electrical Nonmetallic Tubing (ENT)

NEMA TC 13.

2.1.4.3 Electrical Plastic Tubing and Conduit

NEMA TC 2.

2.1.4.4 Flexible Conduit, Steel and Plastic

General-purpose type, UL 1; liquid tight, UL 360, and UL 1660

2.1.4.5 Intermediate Metal Conduit

UL 1242.

2.1.4.6 Rigid Metal Conduit

UL 6.

2.1.4.7 Rigid Plastic

NEMA TC 2, UL 651 and UL 651A.

2.1.4.8 Surface Metal Electrical Raceways and Fittings

UL 5.

2.1.5 Conduit and Device Boxes and Fittings

2.1.5.1 Boxes, Metallic Outlet

NEMA OS 1 and UL 514A.

2.1.5.2 Boxes, Switch (Enclosed), Surface-Mounted

UL 98.

2.1.5.3 Fittings for Conduit and Outlet Boxes

UL 514B.

2.1.5.4 Fittings, PVC, for Use with Rigid PVC Conduit and Tubing

UL 514B.

2.1.6 Connectors, Wire Pressure

2.1.6.1 Copper Conductors

UL 486A.

2.1.6.2 Aluminum Conductors

UL 486B.

2.1.7 Electrical Grounding and Bonding Equipment

UL 467.

2.1.7.1 Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 and not less than 3/4 inch in diameter by 8 feet in length, driven full length into the earth.

2.1.7.2 Ground Bus

The ground bus shall be bare conductor or flat copper in one piece, if practicable.

2.1.8 Enclosures

NEMA ICS 6 or NEMA 250 unless otherwise specified.

2.1.8.1 Cabinets and Boxes

UL 50.

2.1.8.2 Circuit Breaker

UL 489.

2.1.9 Fixtures, Lighting and Fixture Accessories/Components

Fixtures are as shown on contract drawings. Indicated fixtures, accessories and components, including ballasts, lampholders, lamps, starters and starter holders, shall conform to industry standards specified below.

2.1.9.1 Fixture, Auxiliary or Emergency

UL 924.

2.1.9.2 Incandescent Fixture

NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1571.

2.1.9.3 Fluorescent

a. Fixture: NEMA LE 4 for ceiling compatibility of recessed fixtures and UL 1570.

b. Ballast High-Power Factor, Class P, Automatic-Resetting Type: ANSI C82.1 and UL 935.

c. Lampholders, Starters, and Starter Holders: UL 542.

2.1.9.4 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.

2.1.10 Fuses and Fuseholders

2.1.10.1 Fuses, Low Voltage Cartridge Type

NEMA FU 1.

2.1.10.2 Fuses, High-Interrupting-Capacity, Current-Limiting Type

UL 198C.

2.1.10.3 Fuses, Class K, High-Interrrupting-Capacity Type

UL 198D.

2.1.10.4 Fuses, Class R

UL 198E.

2.1.10.5 Fuses for Supplementary Overcurrent Protection

UL 198G.

2.1.10.6 Fuseholders

UL 512.

2.1.11 Motors, AC, Fractional and Integral Horsepower (500 Hp and Smaller)

NEMA MG 1 and UL 1004 for motors and NEMA MG 10 for energy management selection of polyphase motors.

2.1.12 Motor Controls

NEMA ICS 1, NEMA ICS 2, NEMA ICS 3 and NEMA ICS 6, and UL 508.

2.1.13 Panelboards

Dead-front construction, NEMA PB 1 and UL 67.

2.1.14 Receptacles

2.1.14.1 General Grade

NEMA WD 1.

2.1.14.2 Ground Fault Interrupters

UL 943, Class A or B.

2.1.15 Service Equipment

UL 869A.

2.1.16 Splic, Conductor

UL 486C.

2.1.17 Switchboard, Dead Front Distribution

NEMA PB 2 and UL 891.

2.1.18 Snap Switches

UL 20.

2.1.19 Tapes

2.1.19.1 Plastic Tape

UL 510.

2.1.19.2 Rubber Tape

UL 510.

2.1.20 Transformers, Conventional Dry-Type

Specialty or General Applications: NEMA ST 20 and UL 506 unless otherwise shown or specified.

2.1.21 Wiring Devices

NEMA WD 1 for general-purpose 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. 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.

3.2 WIRING METHODS

3.2.1 General Requirements

Unless otherwise indicated, wiring shall consist of insulated conductors installed in rigid aluminum or rigid zinc-coated steel conduit, rigid plastic conduit, electrical metallic and/or nonmetallic tubing, or intermediate metal conduit. Nonmetallic-sheathed cables or metallic-armored cables may be installed in areas permitted by NFPA 70.

3.2.2 Conduit and Tubing Systems

Conduit and tubing systems shall be installed as indicated. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph: WIRING METHODS. Minimum size of raceways shall be 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. Electrical metallic tubing may be installed in concrete and grout in dry locations. EMT will not be installed in damp or wet locations. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Only UL listed adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. 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. Except as otherwise specified, IMC may be used as an option for rigid steel conduit in areas as permitted by NFPA 70. Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept 6 inches away from parallel runs of flues, steam pipes and hot-water pipes. Raceways shall be concealed within finished walls, ceilings, and floors unless otherwise shown. Raceways crossing structural expansion joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding. Wiring installed underfloor shall be suitable for installation in wet locations.

3.2.2.1 Below Slab-on-Grade or in the Ground

All electrical wiring below slab-on-grade shall be protected by a conduit system. Conduit passing vertically through slabs-on-grade shall be rigid steel. Rigid steel

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.

3.2.2.2 Installing in Slabs Including Slabs on Grade

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.

3.2.2.3 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.

3.2.2.4 Changes in Direction of Runs

Changes in direction of runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Care shall be taken to prevent the lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment during the course of construction. Clogged raceways shall be entirely freed of obstructions or shall be replaced.

3.2.2.5 Supports

Metallic conduits and tubing shall be securely and rigidly fastened in place at intervals of not more than 10 feet and within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangers, threaded C-clamps, or ceiling trapeze. C-clamps or beam clamps shall have strap or rod-type retainers. Loads and supports shall be coordinated with supporting structure to prevent damage or deformation to the structures, but no load shall be applied to joist bridging. Fastenings shall be by wood screws or screw-type nails to wood; by toggle bolts on hollow masonry units; by expansion bolts on concrete or brick; by machine screws, welded threaded studs, heat-treated or spring-steel-tension clamps on steel work. Nail-type nylon anchors or threaded studs driven in by a powder charge and provided with lock washers and nuts may be used in lieu of expansion bolts or machine screws. Raceways or pipe straps shall not be welded to steel structures. Holes cut to a depth of more than 1-1/2 inches in reinforced concrete beams or to a depth of more than 3/4-inch in concrete joists shall avoid the main reinforcing bars. Holes not used shall be filled. In partitions of light steel construction, sheet-metal screws may be used. Conduit shall not be supported using wire or nylon ties. Raceways shall be installed as a complete system and be independently supported from the structure. Upper raceways shall not be the support of lower raceways. Supporting means will not be shared between electrical raceways and mechanical piping or ducts and shall not be fastened to hung ceiling supports. Conduits shall be fastened to all sheet-metal boxes and cabinets with two locknuts where required by the NFPA 70, where insulating bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, a single locknut and bushing may be used. Threadless

fittings for electrical metallic tubing shall be of a type approved for the conditions encountered. A pull wire shall be inserted in each empty raceway in which wiring is to be installed by others if the raceway is more than 50 feet in length and contains more than the equivalent of two 90-degree bends, or where the raceway is more than 150 feet in length. The pull wire shall be of No. 14 AWG zinc-coated steel, or of plastic having not less than 200-pound tensile strength. Not less than 10 inches of slack shall be left at each end of the pull wire. Additional support for horizontal runs is not required when EMT rests on steel stud cutouts.

3.2.2.6 Communications Raceways

Communications raceways indicated shall be installed in accordance with the previous requirements for conduit and tubing and with the additional requirements that no length of run shall exceed 50 feet for 1/2-inch and 3/4-inch sizes, and 100 feet for 1-inch or larger sizes, and shall not contain more than two 90-degree bends or the equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated. Inside radii of bends in conduits of 1-inch size or larger shall be not less than ten times the nominal diameter.

3.2.3 Cables and Conductors

Aluminum conductors shall have ampacity of not less than the copper conductors. Wire connectors of insulating material or solderless pressure connectors properly taped shall be utilized for all splices. Pressure connectors for aluminum conductors shall have tinned aluminum bodies. Aluminum contact surfaces of conductors and connectors shall be cleaned and covered with antioxidant compound prior to making of connections.

3.2.3.1 Sizes

All sizes are based on copper conductors, unless otherwise indicated. Sizes shall be not less than indicated. Branch-circuit conductors shall be not smaller than No. 12 AWG. Conductors for branch circuits of 120 volts more than 100 feet long 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.

a. The conductor sizes are based on the use of TW insulation for conductors smaller than No. 1/0 AWG and THW insulation for conductors No. 1/0 and larger, except where otherwise indicated.

b. Higher temperature rated conductors shall be permitted to be used, if the UL tested temperature ratings for which the equipment in the circuit is marked are not exceeded.

c. Conductor sizes for nonlinear loads shall be based on the use of minimum 75 degrees C insulated conductors for branch circuits and feeders.

3.2.3.2 Power Conductor Identification

All phase conductors shall be identified by color-coding. The color of the insulation on the phase conductors of different voltage systems shall be as follows:

120/208 volt, 3-phase: black, red, and blue.
277/480 volt, 3-phase: Brown, orange, and yellow.
120/240 volt, single/phase: Black and red.

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. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions.

3.2.3.3 Control Conductor Identification

Control circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

3.3 BOXES AND SUPPORTS

Boxes shall be provided in the wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways, 4-inch by 4-inch nominal size and smaller, shall be of the cast-metal hub type when located: in normally wet locations; on outside of exterior surfaces; or in hazardous areas. Large size boxes shall be NEMA 1 or as shown. Boxes in other locations shall be sheet steel. In partitions of light steel construction bar hangers with 1-inch long studs, mounted between metal wall studs or metal stud "C" brackets snapped on and tab-locked to metal wall studs, shall be used to secure boxes to the building structure. When "C" brackets are used, additional box support shall be provided on the side of the box opposite the brackets. The edges of boxes for electrical devices shall be flush with the finished surfaces in gypsum and plasterboard installations. Boxes for mounting lighting fixtures shall not be less than 4-inches square except as approved to be required by fixture configuration. Boxes installed for concealed wiring shall be provided with suitable extension rings or plaster covers, as required. The bottom of boxes installed in masonry-block walls for concealed wiring shall be flush with the top of a block to minimize cutting of blocks, and boxes shall be located horizontally to avoid cutting webs of block. Indicated elevations are approximate. Unless otherwise indicated, boxes for wall switches shall be mounted 48 inches above finished floors. Cast-metal boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed. 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. Boxes and supports shall be fastened to wood with wood screws or screw-type nails of equal holding strength, with bolts and metal expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel work. Threaded studs driven in by powder charge and provided with lockwashers and

nuts, or nail-type nylon anchors may be used in lieu of expansion shields, or machine screws. In open overhead spaces, cast-metal boxes threaded to raceways need not be separately supported except where used for fixture support; cast-metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers. Hangers shall not be fastened to or supported from joist bridging. Cast-metal boxes with 3/32-inch wall thickness are acceptable. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved type fastener not more than 24 inches from the box. Penetration of more than 1-1/2 inches into reinforced-concrete beams or more than 3/4-inch into reinforced-concrete joists shall avoid cutting any main reinforcing steel.

3.3.1 Boxes for Use with Raceway Systems

Boxes for use with raceway systems shall be not less than 1-1/2 inches deep except where shallower boxes required by structural conditions are approved. Sheetmetal boxes for other than lighting fixtures shall be not less than 4 inches square except that 4- by 2-inch boxes may be used where only one raceway enters the outlet. Contractor shall size the telephone outlet boxes as required by the number, size and type of outlets specified and as required by the outlets furnished by the Contractor.

3.3.2 Pull Boxes

Pull boxes of not less than the minimum size required by the NFPA 70 shall be constructed of aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified above. Boxes shall be furnished with screw-fastened covers. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation.

3.3.3 Floor Outlets

Floor outlets shall be adjustable and each outlet shall consist of a cast-metal body with threaded openings for conduits, adjustable ring, and cover plate with 1/2- or 3/4-inch threaded flush plug. Each telephone outlet shall consist of a horizontal cast housing with a 1-inch bushed side opening. Each receptacle outlet shall consist of a horizontal cast housing with a receptacle as specified. Gaskets shall be used where necessary to ensure a watertight installation. Plugs with installation instructions shall be delivered to the Contracting Officer at the job site for capping outlets upon removal of service fittings.

3.3.4 Conduit Stub-Ups

Conduits stubbed up through concrete floors for connections to freestanding equipment shall be provided with a short elbow and an adjustable top or coupling threaded inside for plugs, set 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. Screwdriver-operated threaded flush plugs shall be installed in conduits from which no equipment connections are made to suit the devices installed.

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 satin finish corrosion resistant stainless steel or of satin finish chromium plated brass. Screws shall be of metal with countersunk heads, in a color to match the finish of the plate. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed with an alignment tolerance of 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

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 black to match color of switch handles in the same room or to harmonize with the color of the respective wall, and supported by mounting strap having plaster ears. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side- or back-wired with two screws per terminal. The third grounding pole shall be connected to the metal mounting yoke. Switched receptacles shall be the same as other receptacles specified except that the ungrounded pole of each suitable receptacle shall be provided with a separate terminal. Only the top receptacle of a duplex receptacle shall be wired for switching application. Receptacles with ground fault circuit interrupters shall have the current rating as indicated, and shall be the UL Class A type unless otherwise shown. Ground fault circuit protection shall be provided everywhere as required by the National Electrical Code and in addition all the following receptacle locations; exterior including those on roofs, bathrooms with showers, shops, hangars, and garages.

3.5.2 Weatherproof

Weatherproof receptacles shown shall be mounted in a box with a gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. The cap shall be provided with a spring-hinged flap.

3.5.3 Receptacles, 15-Ampere, 250-Volt

Receptacles, 15-ampere, 250-volt, shall be single two-pole, three-wire, grounding type with bodies of ivory phenolic compound supported by mounting yoke having plaster ears. The third grounding pole shall be connected to the metal yoke. Each receptacle shall be provided with a mating cord-grip cap.

3.5.4 Receptacles, 20-Ampere, 250-Volt

Receptacles, single, 20-ampere, 250-volt, shall be molded plastic, two-pole, three-wire or three-pole, four-wire, grounding type complete with appropriate mating cord-grip plug.

3.5.5 Special-Purpose or Heavy-Duty Receptacles

Special-purpose or heavy-duty receptacles shall be of the type and of ratings and number of poles indicated or required for the anticipated purpose. Contact surfaces may be either round or rectangular. One appropriate straight or angle-type plug shall be furnished with each receptacle. Locking of receptacles, indicated to be the locking type, shall be accomplished by the rotation of the plug.

3.6 WALL SWITCHES

Wall switches shall be of the totally enclosed tumbler type. The wall switch handle and switch plate color shall harmonize with the color of the respective wall. Wiring terminals shall be of the screw type or of the solderless pressure type having suitable conductor-release arrangement. Not more than one switch shall be installed in a single-gang position. Switches shall be rated 20-ampere 120-volt for use on alternating current only. Pilot lights indicated shall consist of yoke-mounted candelabra-base sockets rated at 75 watts, 125 volts, and fitted with glass or plastic jewels. A clear 6-watt lamp shall be furnished and installed in each pilot switch. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be red. Dimming switches shall be solid-state flush mounted, sized for the loads.

3.7 SERVICE EQUIPMENT

Service-disconnecting means shall be of the fusible safety switch type as indicated with external handle for manual operation. When service disconnecting means is a part of an assembly, the assembly shall be listed as suitable for service entrance equipment. Enclosures shall be sheet metal with hinged cover for surface mounting unless otherwise indicated.

3.8 PANELBOARDS AND LOADCENTERS

Circuit breakers and switches used as a motor disconnecting means, and not in sight of the motor and the driven machinery location, shall be capable of being locked in the open position. 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 or aluminum.

3.8.1 Loadcenters

Loadcenters shall be circuit breaker equipped.

3.8.2 Panelboards

Panelboards shall be circuit breaker equipped. Switches serving as a motor disconnect means shall be of the tumbler switch and fuse type. Switches serving as motor disconnect means shall be horsepower rated in conformance with UL 98.

3.9 DEAD FRONT DISTRIBUTION SWITCHBOARDS

Assemblies shall be metal-enclosed, freestanding general-purpose type and shall be installed to provide front access. Busses shall be copper or aluminum. Assembly shall be approximately 90 inches high; arrangement of fused switches shall be as

indicated. The Ampere-Interrupting-Capacity (A.I.C.) rating of the switchboards and fuses shall be based on the maximum fault current available.

3.10 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 manufacturer of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting-capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination.

3.10.1 Cartridge Fuses; Current-Limiting Type

Cartridge fuses, current-limiting type, Class RK5 shall have tested interrupting capacity not less than 100,000 amperes. Fuse-holders shall be the type that will reject all Class H fuses.

3.11 UNDERGROUND-SERVICE CONDUITS

Empty conduits for underground electric-service cable and telephone cable shall be installed as indicated. Except where otherwise indicated, conduits shall terminate approximately 5 feet beyond the building wall and 2 feet below finished grade, with the outside ends bushed and plugged or capped.

3.12 MOTORS

Motors shall be as specified in paragraph: MATERIALS AND EQUIPMENT for Motors, AC, Fractional and Integral Horsepower (500 Hp and Smaller), whether or not motors are separately provided or included in equipment assemblies specified in other sections of these specifications. 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.

3.13 MOTOR CONTROL

Each motor or group of motors requiring a single control and not controlled from a motor-control center shall be provided under other sections of these specifications with a suitable controller and devices that will perform the functions as specified

for the respective motors. Each motor of 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 motor-control circuit in both the Manual and the Automatic positions of the selector switch. Control circuit connections to any MANUAL-OFF-AUTOMATIC switch or to more than one automatic regulatory control device shall be made in accordance with wiring diagram approved by the Contracting Officer unless such diagram is included on the drawings. All controls shall be 120 volts or less unless otherwise indicated.

3.13.1 Contacts

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.

3.14 MOTOR-DISCONNECT MEANS

Each motor shall be provided with a disconnecting means when required by NFPA 70 even though not indicated. For single-phase motors, a single- or double-pole toggle switch, rated only for alternating current, will be acceptable for capacities less than 30 amperes, provided the ampere rating of the switch is at least 125 percent of the motor rating. Switches shall disconnect all ungrounded conductors.

3.15 TRANSFORMERS

Only single- and three-phase transformers having two windings per phase will be approved. Full-capacity standard NEMA taps shall be provided in the primary windings of transformers having a primary rating in excess of 600 volts. The insulation on transformer windings may be the manufacturer's standard for transformers rated for operation in a 40-degree Celsius ambient temperature unless a higher-temperature insulation is shown, specified or required by the application indicated. Single kVA ratings shown are based on self-cooled operation. The basic impulse level (BIL) of

individual transformers shall be as stated in the following paragraphs. The average sound level in decibels (dB) of transformers shall not exceed the following dB level for the applicable kVA rating range listed:

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

3.15.1 Conventional Dry-Type Transformers

Transformers having the primary or higher-voltage winding rated at 600 volts or less and a secondary or lower-voltage winding rated at 240 volts or less may be manufacturer's standard ventilated or enclosed, self-cooled type of transformer unless otherwise shown, specified or required for proper and safe application.

3.16 LAMPS AND LIGHTING FIXTURES

Ballasted fixtures shall have ballasts which are compatible with the specific type and rating of lamps indicated and shall comply with the applicable provisions of the publications referenced.

3.16.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed in the fixtures just prior to the completion of the project.

3.16.1.1 Incandescent

Incandescent lamps shall be for 125-volt operation unless otherwise indicated.

3.16.1.2 Fluorescent

Fluorescent lamps shall have standard cool-white color characteristics and shall be of a type that will not require starter switches. Lamps shall be of the rapid-start type unless otherwise shown or approved.

3.16.1.3 High-Intensity-Discharge

High-intensity-discharge lamps shall be the high-pressure-sodium type unless otherwise indicated, shown, or approved.

3.16.2 Fixtures

Fixtures shall be as shown and shall conform to the fixture schedule on drawings. Fixtures of similar designs and equivalent energy efficiency, light-distribution and brightness characteristics, and of equal finish and quality will be acceptable if approved. In suspended acoustical ceilings with fluorescent fixtures, the fluorescent emergency light fixtures shall be furnished with self-contained battery packs.

3.16.2.1 Accessories

Accessories such as straps, mounting plates, nipples, or brackets shall be provided for proper installation. Open type fluorescent fixtures with exposed lamps shall have a wire-basket type guard.

3.16.2.2 Suspended Fixtures

Suspended fixtures shall be provided with swivel hangers in order to ensure a plumb installation. Pendants rods or chains 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.

3.16.2.3 Ceiling Fixtures

Ceiling fixtures shall be coordinated with and suitable for installation in, on, or from the suspended ceiling provided under other sections of these specifications. Installation and support of fixtures shall be in accordance with the NFPA 70 and manufacturer's recommendations. Where seismic requirements are specified herein, fixtures shall be supported as shown or specified. Recessed fixtures shall have adjustable fittings to permit alignment with ceiling panels. Recessed fixtures installed in fire-resistive type of suspended ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling panels, in conformance with UL-03. Surface-mounted fixtures shall be suitable for fastening to the structural support for ceiling panels.

3.16.2.4 Sockets

Sockets of industrial, strip, and other open type fluorescent fixtures shall be of the type requiring a forced movement along the longitudinal axis of the lamp for insertion and removal of the lamp.

3.17 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.

3.17.1 Motors and Motor Control

Control equipment furnished under this section of the specifications, and shown on the drawings, shall be connected under this section of the specifications unless shown or specified otherwise. Except as otherwise specifically noted, automatic-control wiring, signaling, and protective devices are not included in this section of the specifications, but shall be furnished and installed under other sections of the specifications. Control wiring not shown on the drawings shall be furnished under the other sections of the specifications.

3.18 PAINTING AND FINISHING

Field-applied paint on exposed surfaces shall be provided under SECTION: PAINTING, GENERAL.

3.19 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.

3.20 TESTS

After the interior-wiring-system installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. Continuity test shall be conducted on the telephone wiring system. The test shall be performed in the presence of the Contracting Officer. The Contractor shall furnish all instruments and personnel required for the tests, and the Government will furnish the necessary electric power. No part of the electrical distribution system shall be energized prior to the resistance testing of that systems ground rods and submission of test results to the Contracting Officer. Test reports shall indicate the location of the rod and the resistance and the soil conditions at the time the test was performed.

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SECTION 16721

FIRE DETECTION AND ALARM 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.

FEDERAL STANDARDS (FED-STD)

FED-STD 595	(Rev B) Colors

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1980) Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1990) National Electrical Code
NFPA 72	(1990) Installation, Maintenance and Use of Protective Signaling Systems
NFPA 72E	(1990) Automatic Fire Detectors
NFPA 72G	(1989) Installation, Maintenance, Use of Notification Appliances for Protective Signaling Systems
NFPA 72H	(1988) Testing Procedures for Local, Auxiliary, Remote Station and Proprietary Protective Signaling Systems
NFPA 90A	(1989) Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL-04	(1992) Fire Protection Equipment Directory
UL 6	(1981; Rev thru Jul 1991) Rigid Metal Conduit

UL 38	(1987; Rev Jun 1987) Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems
UL 268	(1989; Rev May 1989) Smoke Detectors for Fire Protective Signaling Systems
UL 464	(1990) Audible Signal Appliances
UL 521	(1988) Heat Detectors for Fire Protective Signaling Systems
UL 797	(1983; Rev thru Jul 1991) Eletrical Metallic Tubing
UL 864	(1991) Control Units for Fire-Protective Signaling Systems
UL 1242	(1983; Rev thru Jun 1991) Intermediate Metal Conduit

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall be items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that can provide service within 24 hours.

1.2.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.2.3 Keys and Locks

Locks shall be keyed alike.

1.2.4 Tags

Tags with stamped identification number shall be furnished for keys and locks.

1.2.5 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.2.6 Compliance

The fire detection and internal alarm system and the central reporting system shall be configured in accordance with NFPA 72. The equipment furnished shall be compatible and be UL listed or FM approved or approved or listed by a nationally recognized testing laboratory in accordance with the applicable NFPA standards.

1.2.7 Manufacturer's Services

Services of a manufacturer's representative who is experienced in the installation, adjustment, testing, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.3 SYSTEM DESIGN

1.3.1 Operation

The fire alarm and detection system shall be a complete, supervised fire alarm system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected to initiating device circuits IDC, Style D, in accordance with NFPA 72. Alarm indicating appliances shall be connected to indicating appliance circuits (IAC), Style X in accordance with NFPA 72. A two-loop conduit system shall be provided so that if any one conduit and all conductors contained in that conduit are severed all IDC or IAC on that circuit shall remain functional. A two-loop system is not applicable to the central fire alarm communication center from the local panels. All textual, audible, and visual appliances and systems shall comply with NFPA 72 and NFPA 72G.

1.3.2 Operational Features

The system shall have the following operating features:

a. Electrical supervision of alarm IDC and IAC. Smoke detectors shall have combined alarm initiating and power circuits.

b. Electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.

c. Trouble buzzer and trouble lamp (light emitting diode or neon light) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator lamp. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

d. Transmitter disconnect switch to allow testing and maintenance of the system without activating the transmitter but shall provide a trouble signal when disconnected and a restoration signal when reconnected.

e. Evacuation alarm silencing switch or switches which, when activated, will silence alarm devices, but will not affect the zone indicating lamp nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed zone and the alarm devices will be activated.

f. Electrical supervision of circuits used for supervisory signal services. Supervision shall detect any open, short, or ground.

g. Confirmation or verification modules used on smoke detection initiating circuits. The modules shall interrupt the transmission of an alarm signal to the system control panel for a factory set period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 20 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal if present will be sent immediately to the control panel. All fire alarm devices other than smoke detectors shall be prohibited on circuits controlled by confirmation or verification modules.

h. Zones for alarm IDS shall be arranged as indicated on the contract drawings.

1.3.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following functions:

a. Transmission of signals over the building telephonic fire reporting system.

b. Visual indications of the alarmed zones on the fire alarm control panel annunciator and on the remote annunciator.

c. Continuous sounding of alarm notification appliances throughout the building.

d. Deactivation of the air handling units in the alarmed zone.

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 "FIO" designation are for information only. The following shall be submitted in accordance with SECTION: SUBMITTAL DESCRIPTIONS:

1.4.1 SD-01, Data

Battery; GA.

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; GA.

Voltage drop calculations for signaling appliance circuits to indicate that sufficient voltage is available for proper appliance operation.

Spare Parts; GA.

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; GA.

Qualifications, with verification or license number, of the registered Fire Protection Engineer or a Registered Professional Engineer who has at least 4 years of current experience in the design of the fire protection and detection systems.

1.4.2 SD-04, Drawings

Fire Alarm Reporting System; GA.

Detail drawings, signed by the Fire Protection Engineer, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. Detail drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.

Detailed point-to-point wiring diagram, signed by the Fire Protection Engineer, showing all points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and all equipment that is activated or controlled by the panel.

1.4.3 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; GA.

Lesson plans and training data, in manual format, for the training courses.

1.4.4 SD-08, Statements

Test Procedures; GA.

Detailed test procedures, signed by the Fire Protection Engineer, for the fire detection and alarm system 60 days prior to performing system tests.

1.4.5 SD-09, Reports

Testing; GA.

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.

1.4.6 SD-13, Certificates

Equipment; FIO.

Certified copies of current approvals or listings issued by UL, FM or other nationally recognized testing laboratory, showing compliance with specified NFPA standards.

Installer; FIO.

Evidence that the installer of the system is listed in UL-04 under Protection Signaling Services-Local, Auxiliary, Remote Station Proprietary (UUJS).

1.5 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, and any other contaminants.

PART 2 PRODUCTS

2.1 CONTROL PANEL

Control Panel shall comply with all the applicable requirements of UL 864. Panel shall be modular, installed in a flush mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a clean, uncluttered, and orderly assembled panel containing all components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic, phenolic or metal identification plates for all lamps, zones, controls, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. Separate alarm and trouble lamp shall be provided for each zone alarm located on exterior of cabinet door or be visible through the cabinet door. Control panel switches shall be within the locked cabinet. A suitable means shall be provided for testing the control panel visual indicating devices (meters or lamps). Meters and lamps shall be plainly visible when the cabinet door is closed. Signals shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Each IDC initiating circuit shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other zones. Loss of power, including any or all batteries, shall not require the reloading of a program. Upon restoration of power, startup shall be automatic, and shall not require any manual operation. The loss of primary power or the sequence of applying primary or emergency power shall not affect the transmission of alarm, supervisory or trouble signals.

Visual annunciators shall be provided for each active zone and spare zone. One spare zone shall be provided as shown on the drawing. Each lamp shall provide specific identification of the zone by means of a permanently attached rigid plastic, phenolic or metal sign with either raised or engraved letters. Zone identification shall consist of word description of the zone.

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. All shall be painted red similar to FED-STD 595 color, number 11105.

2.1.1 Circuit Connections

Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each terminal marked for identification.

2.2 STORAGE BATTERIES

Storage batteries shall be provided and shall be the sealed, lead-calcium type requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 48 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a minimum period of 30 minutes. Batteries shall be sized to deliver 50 percent more ampere/hours based on a 48 hour discharged rate than required for the calculated capacities. Battery cabinet shall be a separate compartment within the control panel. Batteries in the control panel shall be located at the bottom of the panel.

2.3 BATTERY CHARGER

Battery charger shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 12 hours. A separate ammeter shall be provided for indicating rate of charge. A separate voltmeter shall be provided to indicate the state of the battery charge. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly if a high rate switch is provided. Charger shall be located in battery compartment of the control panel.

2.4 MANUAL FIRE ALARM STATIONS

Manual fire alarm stations shall conform to the applicable requirements of UL 38. Manual stations shall be connected into alarm-initiating circuits. Stations shall be installed on 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 or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the voltage and current upon which they operate. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be painted the same color as the fire alarm manual stations.

2.5 FIRE DETECTING DEVICES

Fire detecting devices shall comply with the applicable requirements of NFPA 72E, 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.

2.5.1 Smoke Detectors

Detectors shall be designed for detection of abnormal smoke densities. Smoke detectors shall be photoelectric type. Detectors shall contain a visible indicator lamp that shows when the unit is in alarm condition. Detectors shall not be adversely affected by vibration or pressure. Detectors shall be the plug-in type in which the detector base contains terminals for making all wiring connections. Detectors that are in concealed (above false ceilings, etc.) locations shall have a remote visible indicator lamp.

2.5.1.1 Photoelectric Detectors

Detectors shall operate on a light scattering concept using an LED light source. Failure of the LED shall not cause an alarm condition. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind. Detectors shall have an obscuration rating between 1.9 and 2.4 percent per foot when tested in accordance with UL 268.

2.5.1.2 Duct Detectors

Detectors shall be designed for detection of abnormal smoke densities. Each duct detector shall activate a visual ammunciator on the control panel in the case of abnormal smoke density. Detectors shall be factory set for sensitivity and shall require no field adjustments of any kind.

2.6 NOTIFICATION APPLIANCES

Audible appliances shall be heavy duty and conform to the applicable requirements of UL 464. Devices shall be connected into alarm indicating circuits. All devices shall have a separate screw terminal for each conductor. All shall be painted [ed similar to FED-STD 595 color, number 11105.

2.6.1 Alarm Horns

Horns shall be surface mounted, with the matching mounting back box recessed grill and vibrating type suitable for use in an electrically supervised circuit. Horns shall produce a minimum sound rating of at least 100 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.

2.6.2 Visual Notification Appliances

Visual notification appliances shall have high intensity optic lens and flash tubes. Strobes shall flash at approximately 2 flash per second and a minimum of 1 candela (8,000 peak candle power). Strobe shall be semi-flush mounted.

2.6.3 Combination Audible/Visual Notification Appliances

Combination audible/visual notification appliances shall provide the same requirements as individual units except they shall mount as a unit in standard backboxes. All units shall be factory assembled. Any other audible indicating appliance employed in the fire alarm systems shall be approved by the authority having jurisdiction.

2.7 REMOTE ANNUNCIATION EQUIPMENT

2.7.1 Remote Annunciator

Annunciator shall have relampable indicator lamps. The lamp (LED) for the proper zone shall light upon any alarm, supervisory or trouble condition on the fire alarm system. Annunciator lamps shall be extinguished only by operating the alarm reset switch on the control panel. Annunciator shall contain a lamp test switch, an audible trouble signal and a trouble silence switch to silence the audible alarm, but not extinguish the trouble lamp. Switches shall be located within a locked panel, and easily visible through a glass or plastic viewing plate. Panel door shall have a keyed lock identical to the lock on the control panel. Zone identification shall be by silk-screened or engraved labels and shall consist of word description of the zone. Annunciator shall be flush mounted.

2.8 FIRE DETECTION AND ALARM SYSTEM PERIPHERAL EQUIPMENT

2.8.1 Conduit

Conduit and fittings shall comply with UL 6, UL 1242 and UL 797.

2.8.2 Wiring

Wiring for 120V ac power shall be No. 12 AWG minimum. Wiring for low voltage dc circuits shall be No. 16 AWG minimum. Power wiring (over 28 volts) and control wiring shall be isolated. All wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing, except rigid plastic conduit may be used under slab-on-grade. All conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to alarm initiating, supervisory circuits, and alarm indicating circuits are prohibited. T-tapping using screw terminal blocks is allowed for addressable systems.

2.8.3 Special Tools and Spare Parts

Special tools necessary for the maintenance of the equipment shall be furnished. Two spare fuses of each type and size required and five spare lamps and LED's of each type shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Fuses and lamps shall be mounted in the fire alarm panel.

PART 3 EXECUTION

3.1 INSTALLATION

All work shall be installed as shown and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until the building has been thoroughly cleaned.

3.1.1 Power Supply for the System

A single dedicated branch-circuit connection for supplying power to each building fire alarm system shall be provided. The primary power shall be single phase supplied from a branch circuit with lock-on device from indicated panel. Panel shall be equipped with one 20 amp circuit breaker and key locked. Panel shall be marked "FIRE ALARM CIRCUIT CONTROL" with a rigid plastic nameplate.

3.1.2 Wiring

Wiring for systems shall be installed in 3/4-inch minimum diameter conduit. 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 72E. 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. Duct detectors shall not inhibit the function of the ducts whatsoever.

3.1.5 Notification Appliances

Notification appliances shall be mounted a minimum of 8 feet above the finished floor unless limited by ceiling height or otherwise indicated.

3.2 OVERVOLTAGE AND SURGE PROTECTION

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 and NFPA 70. All cables and conductors which serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for surge protection.

3.3 GROUNDING

Grounding shall be provided to building ground. Maximum impedance to ground shall be 25 ohms.

3.4 TESTING

The Contractor shall notify the Contracting Officer 30 days before the preliminary and acceptance tests are to be conducted. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise all tests. The Contractor shall furnish all instruments and personnel required for the tests.

3.4.1 Preliminary Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance. Tests shall include the meggering of all system conductors to

determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional.

3.4.2 Acceptance Test

Testing shall be in accordance with NFPA 72H. The recommended tests in NFPA 72H shall be considered mandatory and shall verify that all previous deficiencies have been corrected. The test shall include the following:

a. Test of each function of the control panel.

b. Test of each circuit in both trouble and normal modes.

c. Tests of alarm initiating devices in both normal and trouble conditions.

d. Tests of each control circuit and device.

e. Tests of each alarm notification appliance.

f. Tests of the battery charger and batteries.

g. Complete operational tests under emergency power supply.

h. Visual inspection of all wiring connections.

i. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.

j. Ground fault

k. Short circuit faults

l. Stray voltage

m. Loop resistance

3.5 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in the building where the system is installed or as designated by the Contracting Officer. The training period shall consist of 4 hours of training 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.

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SECTION 16752

ELECTRONIC ENTRY 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.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C2	(1990; TIA 90-2; Errata) National Electrical Safety Code

FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 15	(Jul 1986) Rules and Regulations: Radio Frequency Devices

FEDERAL SPECIFICATIONS (FS)

FS W-C-586	(Rev D) Conduit Outlet Boxes, Bodies, and Entrance Caps, Electrical: Cast Metal

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41	(1980) Surge Voltages in Low-Voltage AC Power Circuits
IEEE Std 100	(1988; 4th Ed) IEEE Standard Dictionary of Electrical and Electronics Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(1988; Rev 1 & 2) Industrial Controls and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1990) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6	(1981; Rev thru Jul 1991) Rigid Metal Conduit

UL 294	(1987; Rev thru May 1988) Access Control System Units
UL 681	(1991; Rev thru Sep 1991) Installation and Classification of Mercantile and Bank Burglar-Alarm Systems
UL 796	(1984; Rev thru Jan 1991; Errata Mar 1991) Printed-Wiring Boards
UL 1037	(1988; Rev thru Jul 1991) Antitheft Alarms and Devices
UL 1076	(1988; Rev thru Nov 1991) Proprietary Burglar Alarm Units and Systems

1.2 SYSTEM DESCRIPTION

1.2.1 General

The Contractor shall configure the electronic entry control system (EECS) as a modular, digital-computer-based as specified and as shown. The EECS shall provide operator interface, interaction, and dynamic real-time process manipulation, including overall system supervision, coordination and control. All computing devices, as defined in FCC Part 15, shall be certified to comply with the requirements for Class A or Class B computing devices and labeled as set forth in FCC Part 15. Electronic equipment shall comply with FCC Part 15.

1.2.2 Overall System Reliability Requirements

The EECS, including all components and appurtenances, shall be configured and installed to yield a mean time between failure (MTBF), as defined in IEEE Std 100, of at least 2000 hours continuous operation. Mean time between failure shall be calculated based on the configuration specified in paragraph: Overall System Reliability Calculations.

1.2.3 Alarm Classifications

Definitions and requirements apply to EECS and equipment.

1.2.3.1 Intrusion Alarm

The annunciation of an alarm by the EECS when entry into an access controlled area is attempted without using EECS procedures.

1.2.3.2 Nuisance Alarm

The annunciation of an alarm resulting from the detection of an alarm stimuli, but which does not represent an attempt to intrude into the protected area.

1.2.3.3 Environmental Alarm

The annunciation of a false alarm during environmental conditions which exceed those specified.

1.2.3.4 False Alarm

The annunciation of any alarm when there is no alarm stimulus.

1.2.3.5 Fail-Safe Alarm

The EECS shall include a fail-safe capability in its critical system functions. The EECS shall monitor for proper system functions and report an alarm when a failure is detected. This shall include, but not be limited to, the monitoring of communication circuit integrity and providing self-test. When diminished functional capabilities are detected, the system shall annunciate the fault.

1.2.3.6 Power Loss Alarm

The EECS shall detect when system components experience loss of power exceeding 2 seconds, and shall annunciate an alarm. The alarm shall identify the zone experiencing the power loss. Circuitry shall be designed to fail to an alarm condition with the loss of power.

1.2.3.7 Access Control Alarm

An access control alarm shall be annunciated when the EECS detects improper use of EECS procedures or equipment.

1.2.4 Integrated System Performance Requirements

The installed and operating EECS shall perform as a complete and integrated system as specified.

1.2.4.1 False Alarm Rate

A false alarm rate of less than 1 false alarm per zone per 5 days shall be provided.

1.2.4.2 Error and Throughput Rates

Error and throughput rates shall be single portal performance rates obtained when processing individuals one at a time. If serial verification techniques or multiple attempts are required to satisfy error performance requirements, these features shall not reduce throughput.

1.2.4.3 Type I Error Rate

A Type I error means that the system denies access to an authorized, enrolled individual. The EECS Type I error rate shall be less than 1 percent.

1.2.4.4 Type II Error Rate

A Type II error means that the system grants access to an unauthorized individual. The EECS Type II error rate shall be less than 0.1 percent.

1.2.5 Definition of Passage

Passage shall be defined as ingress or egress past an entry control device, or through a portal. Entry control procedures and equipment shall be implemented for passage through each portal as shown.

1.2.6 Detection Resolution

The system shall have detection resolution sufficient to:

a. Locate intrusions at each device and zone.

b. Locate failures or tampering at individual devices.

1.2.7 Electrical Requirements

Electrically powered EECS equipment shall operate on 120 or 240 volt 60 Hz AC sources as shown. Equipment shall be able to tolerate variations in the voltage source of plus or minus 10 percent, and variations in the line frequency of plus or minus 2 percent with no degradation of performance.

1.2.8 Power Line Surge Protection

All equipment connected to alternating current 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.

1.2.9 Device Wiring and Communication Circuit Surge Protection

All inputs shall be protected against surges induced on device wiring. Outputs shall be protected against surges induced on control and device wiring installed outdoors and as shown. All communications equipment shall be protected against surges induced on any communications circuit. All cables and conductors, except fiber optics, which serve as communications circuits from console to field equipment, and between field equipment, shall have surge protection circuits installed at each end. Protection shall be furnished at equipment, and additional triple electrode gas surge protectors rated for the application on each wireline circuit shall be installed within 3 feet of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following two waveforms:

a. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

b. An 8 microsecond rise time by 20 microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.2.10 Power Line Conditioners

A power line conditioner shall be furnished for the console equipment and each local processor. The power line conditioners shall be of the ferro-resonant design, with no moving parts and no tap switching, while electrically isolating the secondary from the power line side. The power line conditioners shall be sized for 125 percent of the actual connected kVA load. Characteristics of the power line conditioners shall be as follows:

a. At 85 percent load, the output voltage shall not deviate by more than plus or minus 1 percent of nominal when the input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.

b. During load changes of zero to full load, the output voltage shall not deviate by more than plus or minus 3 percent of nominal. Full correction of load switching disturbances shall be accomplished within 5 cycles, and 95 percent correction shall be accomplished within 2 cycles of the onset of the disturbance.

c. Total harmonic distortion shall not exceed 3-1/2 percent at full load.

1.2.11 System Reaction

1.2.11.1 System Response

All alarms shall be annunciated on the console within 2 seconds of them occurring at a local processor or devices controlled by a local processor, and within 100 milliseconds if the alarm occurs at the central processor. Alarm and status changes shall be displayed within 100 milliseconds after receipt of data by the central processor.

1.2.12 Environmental Conditions

1.2.12.1 Interior, Controlled Environment

All system components except the console equipment installed in interior locations having controlled environments shall be rated for continuous operation under ambient environmental conditions of 35 to 120 degrees F dry bulb and 20 to 90 percent relative humidity, noncondensing.

1.2.12.2 Console

All console equipment shall, unless designated otherwise, be rated for continuous operation under ambient environmental conditions of 60 to 85 degrees F and a relative humidity of 20 to 80 percent.

1.2.13 System Capacity

The EECS shall have the capacity to collect, communicate and display up to 8 alarms. The system shall identify individual sensors, switches, and terminal devices in an alarm state. A single alarm shall be annunciated within 2 seconds, after sensor, transducer, terminal device or other device activation.

1.3 DELIVERY OF TECHNICAL DATA AND COMPUTER SOFTWARE

All items of computer software and technical data (including technical data which relates to computer software), which is specifically identified in this specification shall be delivered strictly in accordance with the CONTRACT CLAUSES, SPECIAL CLAUSES, and in accordance with the Contract Data Requirements List (CDRL), DD FORM 1423, which will be available through the Contracting Officer. All data delivered shall be identified by reference to the particular specification paragraph against which it is furnished.

1.3.1 Group I Technical Data Package

1.3.1.1 System Drawings

The data package shall include the following:

a. System block diagram.

b. Console installation, block diagrams, and wiring diagrams.

c. Local processor installation, typical block, and wiring diagrams.

d. Local processor physical layout and schematics.

e. Device wiring and installation drawings.

f. Details of connections to power sources, including power supplies and grounding.

g. Details of surge protection device installation.

1.3.1.2 Manufacturer's Data

The data package shall include manufacturers' data for all materials and equipment, including terminal devices, local processors and security center equipment provided under this specification.

1.3.1.3 System Description and Analyses

The data package shall include system descriptions, analyses, and calculations used in sizing equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance of this specification. The data package shall include the following:

a. Central processor memory size.

b. Communication speed and protocol description.

c. Alarm response time calculations.

d. Command response time calculations.

e. Start-up operations.

f. Expansion capability and method of implementation.

1.4 TESTING

1.4.1 General

The Contractor shall perform predelivery testing, site testing, and adjustment of the completed EECS. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the Government at least 14 days prior to the test, and in no case shall notice be given until after the Contractor has received written approval of the specific test procedures.

1.4.2 Test Procedures and Reports

Test procedures shall explain in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification. Test reports shall be used to document results of the tests. Reports shall be delivered to the Government within 7 days after completion of each test.

1.5 TRAINING

1.5.1 General

The Contractor shall conduct training courses for designated personnel in the maintenance and operation of the EECS as specified. The training shall be oriented to the specific system being installed under this contract. Training manuals shall be delivered for each trainee with two additional copies delivered for archiving at the project site. The manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson. The Contractor shall furnish audio-visual equipment and other training materials and supplies. Where the Contractor presents portions of the course by audio-visual material, copies of the audio-visual material shall be delivered to the Government either as a part of the printed training manuals or on the same media as that used during the training sessions. 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. For guidance in planning the required instruction, the Contractor should assume that attendees will have a high school education or equivalent, and are familiar with EECS. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

1.5.2 Operator's Training I

The first course shall be taught at the project site for a period of 1 training day. Upon completion of this course, each student, using appropriate documentation, should be able to perform elementary operations with guidance and describe the general hardware architecture and functionality of the system. This course shall include:

a. General EECS hardware architecture.

b. Functional operation of the system.

c. Operator commands.

d. Data base entry.

e. Diagnostics.

1.5.3 Maintenance Personnel Training

The system maintenance course shall be taught at the project site after completion of the endurance test for a period of 1 training day. The training shall include:

a. Physical layout of each piece of hardware.

b. Troubleshooting and diagnostics procedures.

c. Repair instructions.

d. Preventive maintenance procedures and schedules.

e. Calibration procedures.

Upon completion of this course, the students shall be fully proficient in the maintenance of the system.

1.6 LINE SUPERVISION

1.6.1 Signal and Data Transmission Media (DTM) Line Supervision

All signal or DTM lines between terminal devices and the alarm annunciation console shall be supervised by the system. The system shall supervise the signal lines by monitoring the circuit for changes or disturbances in the signal, and for conditions as described in UL 1076 for line security equipment. The system shall initiate an alarm in response to a current change of 10 percent or greater. The system shall also initiate an alarm in response to opening, closing, shorting, or grounding of the signal and DTM lines.

1.7 EXPERIENCE

1.7.1 Hardware Manufacturer's Experience

All system components shall be produced by manufacturers who have been regularly engaged in the production of EECS components for at least 5 years.

1.7.2 Software Manufacturer's Experience

All system and application software shall be produced by manufacturers who have been regularly engaged in the production of EECS and application software for at least 2 years.

1.7.3 System Installer Experience

The system shall be installed by a Contractor who has been regularly engaged in the installation of EECS equipment for at least 2 years.

1.8 MAINTENANCE AND SERVICE

1.8.1 General Requirements

The Contractor shall provide all services required and equipment necessary to maintain the entire EECS in an operational state as specified for a period of 1 year after formal written acceptance of the system, and shall provide all necessary material required for performing scheduled adjustments or other nonscheduled work.

1.8.2 Description of Work

The adjustment and repair of the EECS includes all computer equipment, software updates, communications transmission equipment and DTM, local processors, and access control, facility interface, and support equipment. Responsibility shall be limited to Contractor installed equipment. Provide the manufacturer's required adjustments and other work as necessary.

1.8.3 Personnel

Service personnel shall be qualified to accomplish all work promptly and satisfactorily. The Government shall be advised in writing of the name of the designated service representative, and of any change in personnel.

1.8.4 Emergency Service

The Government will initiate service calls when the EECS is not functioning properly. Qualified personnel shall be available to provide service to the complete EECS. The Government shall be furnished with a telephone number where the service supervisor can be reached at all times. Service personnel shall be at the site within 8 hours after receiving a request for service. The EECS shall be restored to proper operating condition within 3 calendar days after receiving a request for service.

1.8.5 Operation

Performance of scheduled adjustments and repair shall include verification of operation of the EECS as demonstrated by the applicable tests of the performance verification test.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

2.1.1 Materials and Equipment

Units of the same type of equipment shall be products of a single manufacturer. All material and equipment shall be new and currently in production. Each major component of equipment shall have the manufacturer's model and serial number in a conspicuous place. Equipment shall conform to UL 294 and UL 1076.

2.1.2 Enclosures

System enclosures shall be metallic as shown.

2.1.2.1 Interior Terminal Device

All terminal devices to be used in an interior environment shall be housed in an enclosure that provides protection against dust, falling dirt, and dripping noncorrosive liquids.

2.1.2.2 Interior Electronics

All system electronics to be used in an interior environment shall be housed in enclosures which meet the requirements of NEMA 250 Type 12.

2.1.3 Tamper Provisions

2.1.3.1 General

Enclosures, cabinets, housings, boxes, and fittings of every description having hinged doors or removable covers, and which contain circuits or connections of the EECS equipment or power supplies, shall be provided with cover operated, corrosion resistant tamper switches, arranged to initiate an alarm signal when the door or cover is moved. Tamper switches shall be mechanically mounted to maximize the defeat time when enclosure covers are opened or removed. It shall take longer than 1 second to depress or defeat the tamper switch after opening or removing the cover. The enclosure and the tamper switch shall function together to not allow direct line of sight to any internal components and tampering with the switch or the circuits before the switch activates. Tamper switches shall: be inaccessible until the switch is activated; have mounting hardware concealed so that the location of the switch cannot be observed from the exterior of the enclosure; be connected to circuits which are under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating; be spring-loaded and held in the closed position by the door cover; and be wired so that they break the circuit when the door or cover is disturbed.

a. Nonsensor Enclosures: Tamper switches on nonsensor enclosures, which must be opened to make routine maintenance adjustments to the system and to service the power supplies, shall be push/pull-set, automatic reset type.

b. Sensor Enclosures: Tamper switches on terminal device enclosures, which must be opened to make routine maintenance adjustments to the device, shall be single pole single throw type.

2.1.4 System Component Design

EECS components shall be designed for continuous operation. All electronic components shall be solid state type, mounted on printed circuit boards conforming to UL 796. Circuitry shall not be so densely placed as to impede maintenance. Printed circuit board connectors shall be plug-in, quick-disconnect type. Power dissipating components shall incorporate safety margins of not less that 25 percent with respect

to dissipation ratings, maximum voltages, and current carrying capacity. Light duty relays and similar switching devices shall be solid state type or sealed electromechanical.

2.1.5 Controls and Designations

Controls and designations shall be as specified in NEMA ICS 1.

2.1.6 Special Test Equipment

The Contractor shall provide all special test equipment, special hardware, software, tools, and programming or initialization equipment needed to start or maintain any part of the system and its components. Special test equipment is defined as any test equipment not normally used in an electronics maintenance facility.

2.2 ELECTRONIC ENTRY CONTROL SYSTEM OPERATION

2.2.1 General

The Contractor shall furnish the EECS complete and ready for operation. The EECS shall operate in a continuous interrogation, control, and response mode. The EECS shall provide a user interface and an operator interface to control system functions. The EECS shall provide a means to enter time, date, and installation-related data such as portal numbers, portal descriptors, central processor addresses, and local processor addresses.

2.2.2 EECS Definitions

2.2.2.1 EECS Identifiers

An identifier shall be a card credential, keypad personal identification number or code, biometric characteristic or any other unique identification entered as data into the EECS database for the purpose of identifying an individual. Identifiers shall be used by the EECS for the purpose of validating passage requests for areas under the control of the EECS.

2.2.2.2 EECS Devices

A terminal device shall be any piece of equipment which gives a user the means to input identifier data into the EECS for verification. A facility interface device shall be any type of mechanism which is controlled in response to passage requests and allows passage through a portal.

2.3 ELECTRONIC ENTRY CONTROL SYSTEM ALARMS

The EECS shall annunciate an alarm when the following conditions occur. All alarms shall be annunciated at the console both audibly and visually. The alarm annunciation shall continue until acknowledged by the system operator. Only one control key shall be needed to acknowledge an alarm. The EECS shall control, monitor, differentiate, rank, annunciate, and allow operators to acknowledge, in real time, alarm signals generated by EECS equipment.

2.3.1 Local Processor Failure

The EECS shall continuously supervise local processor bus lines by monitoring the presence of communications with local processors and shall annunciate an alarm if a communications failure is detected.

2.3.2 Access Denial

The EECS shall annunciate an alarm when an attempt has been made to pass through a controlled portal and access has been denied.

2.3.3 Intrusion Alarm

The EECS shall annunciate alarms based on sensor or tamper alarm. Intrusion alarms shall generate a single unique signal indicative of this alarm type.

2.4 FIELD HARDWARE

2.4.1 Keypads

EECS keypads shall use a unique combination of alphanumeric and other symbols as an identifier. Keypads shall contain an integral alphanumeric/special symbols keyboard with symbols arranged in random scrambled order. Communications protocol shall be compatible with the local processor.

2.4.1.1 Keypad Display

Keypads shall include an LED or other type of visual indicator display and provide visual status indications and user prompts. The display shall indicate power on/off, and whether user passage requests have been accepted or rejected.

2.4.1.2 Keypad Response Time

The keypad shall respond to passage requests by generating a signal to the local processor. The response time shall be 800 milliseconds or less from the time the last alphanumeric symbol is entered until a response signal is generated.

2.4.1.3 Keypad Size and Weight

The keypad shall not be more than 10 inches high by 10 inches wide by 5 inches deep. The keypad shall not weigh more than 10 pounds.

2.4.1.4 Keypad Power

The keypad shall be powered from the source as shown and shall not dissipate more than 150 watts.

2.4.1.5 Keypad Mounting Method

Keypads shall be suitable for surface, semi-flush, pedestal, or weatherproof mounting as required.

2.4.2 Magnetic Door Detector

Magnetic door detector shall be installed within the meter door frame with a floor junction box above the door. The magnetic detector switch shall be designed for the maintaining of the door frame. The magnet shall be mounted in the door.

2.4.3 Passive Inframed Device

The passive inframed detector shall be ambient temperature compensated so that high temperature during unoccupied periods will not desensitize the detector. The beam spread shall be adjustable in the vertical and horizontal plane. The detector shall be selected to provide coverage of entry and exit areas. Operating ambient temperature shall be between 20°F and 115°F.

2.4.4 Standby Power Supplies

2.4.4.1 Console Power Supply

The standby power supply shall provide at least 12 hours battery back-up for the monitoring mode and 1 hour back-up for alarm mode, in the event of primary power failure. Batteries shall be sealed, non-outgassing type.

2.5 WIRE AND CABLE

2.5.1 General

The Contractor shall provide all wires and cables. All wiring shall meet NFPA 70 standards.

2.5.2 Terminal Device Wiring

Terminal device wiring shall be shielded and as needed to match hardware. Multiconductor wire shall be at least 20 AWG and shall have an outer jacket of PVC.

2.5.3 Class 2 Low Energy Conductors

The conductor sizes specified for digital functions shall take precedence over any requirements for Class 2 low energy signal circuit conductors specified elsewhere.

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 as shown, and shall furnish all necessary interconnections, services , and adjustments required for a complete and operable system as specified and shown. Control signal, communications, and data transmission line grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

3.1.1 Installation

The Contractor shall install the EECS in accordance with the standards for safety, NFPA 70, UL 681, UL 1037 and UL 1076, and the appropriate installation manual for each equipment type. Components within the system shall be configured with appropriate service points to pinpoint system trouble in less than 20 minutes. All wiring, including low voltage wiring outside the security control console, cabinets, boxes, and similar enclosures, shall be installed in rigid galvanized steel conduit conforming to UL 6. Minimum size of conduit shall be 1/2-inch. Connections shall be tight tapered threaded. No threadless fittings or couplings shall be used. Conduit outlet boxes, pull boxes, junction boxes, conduit fittings and similar enclosures shall be cast metal or malleable iron conforming to FS W-C-586, with threaded hubs or bodies. Electric metallic tubing (EMT), armored cable, nonmetallic sheathed cable, or flexible conduit will not be permitted except where specifically shown. DTM shall not be pulled into conduits or placed in raceways, compartments, outlet boxes, junction boxes, or similar fittings with other building wiring. Flexible cords or cord connections shall not be used to supply power to any components of the system, except where specifically noted herein. All other electrical work shall be as specified in SECTION: ELECTRICAL WORK, INTERIOR and as shown. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.

3.1.2 Enclosure Penetrations

All 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 all 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.

3.1.3 Cold Galvanizing

All 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.

3.1.4 Current Site Conditions

The Contractor shall verify that site conditions are in agreement with the design package.

3.2 SYSTEM STARTUP

The Contractor shall not apply power to the EECS until after:

a. A visual inspection of the EECS has been conducted to insure that defective equipment items have not been installed and that there are no loose connections.

b. System wiring has been tested and verified as correctly connected as indicated.

c. All system grounding and transient protection systems have been verified as properly installed and connected as indicated.

d. Power supplies to be connected to the EECS have been verified as the correct voltage, phasing, and frequency as indicated.

e. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installations, defective equipment items, or collateral damage as a result of Contractor work/equipment.

-- End of Section --

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