AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF PAGES
	1	3

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. *(If applicable)*
0002	14 APRIL 1999		

6. ISSUED BY CODE

Department of the Army
Corps of Engineers
Fort Worth District

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

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

CODE FACILITY CODE

(√) X

9A. AMENDMENT OF SOLICITATION NO.
DACA63-99-B-0012

9B. DATED *(SEE ITEM 11)*
19 MARCH 1999

10A. MODIFICATION OF CONTRACTS/ORDER NO.

10B. DATED *(SEE ITEM 13)*

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

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

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

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

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

(√) A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation date, etc.)* SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).

C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

D. OTHER *(Specify type of modification and authority)*

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

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

The Solicitation for PRIMARY CARE FACILITY, FORT HOOD, TEXAS, is amended as follows:

See Continuation Sheets.

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

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

Item 14. (cont'd)

a. <u>Standard Form 1442, First Page, Item 13.A</u>.- Change the bid opening date and time from "22 April 1999, 2 p.m. local time" to "27 April 1999, 2 p.m. local time".

b. <u>Specifications</u>

(1) Specification 01320- Page 1. Paragraph 1.1 SD-09, Schedule Updates; FIO. Revise sentence to read .... "Three copies of the reports, <u>to include tabular data, Network diagram, S-curve, and Modification report</u>, in hard copy and on data disk(s), showing numbers, descriptions, dates float, starts, finishes, durations, sequences, etc., as required."

(2) Specification 01320-Page 3. Paragraph 3.3.2, revise the third sentence to read .... "Activity numbers, descriptions, durations, milestones, <u>activity costs, completed progress</u>, and constraint dates must be shown and the critical path easily apparent and distinguishable on all copies of the diagram. "

(3) Specification 01320-Page 4. Add paragraph 3.3.5.5. <u>S-Curves</u>

An S Curve will be provided with the initial and each periodic update of the project schedule showing early, late, actual and projected earnings. It may be on 8" X 11 1/2 " format and shall show both monthly bar charts with a cumulative earnings curve.

(4) Specification 01320-Page 4. Add paragraph 3.3.5.6. <u>Modification Report</u>

A modification report will be provided with the initial and each periodic update of the project schedule listing if all approved modifications. Recommend assigning each modification with an Activity Number which starts with "P" followed by the numerical modification number.

(5) Specification 01330 - Add the following items to the SUBMITTAL REGISTER

Specification/para no.	**Description -- classification**
01340 para 2.1	**Color/Finish Board GA**
01360 para 3.1	**Contractor Verification of Survey Data --FIO**
01410 para 1.1.2	**Enviromental Protection Plan -- GA**
01410 para 1.3.5, 1.3.6	**Contractor Facilities, Temp Layouts -- GA**
01410 para 1.10.1	**Storm Water Pollution Prevention Plan -- GA**
01451	**QC Plan**
01560 para 1.4.2	**Temporary Support Plan -- GA**
01700 para 1.2.1.2	**Draft O & M Manuals --- GA**
01700 para 1.3	**Final O & M Manuals - 6 copies -- GA**
01700 para 1.4.3.3.	**Preliminary Record Drwgs - 2 sets - GA**
01700 para 1.4.3.4.1	**Final Record Drwgs - 3 sets - GA**
01700 para 1.5.1	**Performance Bond - FIO**
01700 para 1.6	**Equipment Warranty Tags - GA**
01700 para 1.7	**Inventory of Equipment & Warranties - GA**

(6) The following sections shall be voided and the attached new sections of the same title and number, each bearing the notation "ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012" shall be substituted therefor:

SECTION 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS
SECTION 02225 EARTHWORK
SECTION 02241 AGGREGATE BASE COURSE
SECTION 02384 DRILLED PIERS
SECTION 02516 CONCRETE PAVEMENT
SECTION 02526 WHEEL STOPS
SECTION 02551 BITUMINOUS PAVING FOR ROADS, STREETS AND OPEN STORAGE AREAS
SECTION 02920 TOPSOILING

SECTION 02960 PLANTING OF TREES, SHRUBS, AND VINES
SECTION 03200 CONCRETE REINFORCEMENT
SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE
SECTION 04255 NONBEARING MASONRY VENEER/STEEL STUD WALL
SECTION 05120 STRUCTURAL STEEL
SECTION 05210 STEEL JOISTS AND JOIST GIRDERS
SECTION 05500 MISCELLANEOUS METAL
SECTION 07175 WATER REPELLANT COATING
SECTION 07220 ROOF INSULATION
SECTION 07412 NON-STRUCTURAL METAL ROOFING
SECTION 08110 STEEL DOORS AND FRAMES
SECTION 08120 ALUMINUM DOORS AND FRAMES
SECTION 08201 WOOD DOORS
SECTION 08331 METAL ROLLING COUNTER DOORS
SECTION 08470 REVOLVING ENTRANCE DOORS
SECTION 08700 BUILDERS' HARDWARE
SECTION 09250 GYPSUM WALLBOARD
SECTION 09510 ACOUSTICAL CEILINGS
SECTION 09650 RESILIENT FLOORING
SECTION 09900 PAINTING, GENERAL
SECTION 09950 WALLCOVERING
SECTION 10260 WALL AND CORNER PROTECTION
SECTION 10800 TOILET ACCESSORIES
SECTION 10990 MISCELLANEOUS SPECIALTIES
SECTION 11702 GENERAL REQUIREMENTS FOR MEDICAL EQUIPMENT
SECTION 12335 CASEWORK FOR MEDICAL FACILITIES
SECTION 12520 WINDOW TREATMENT
SECTION 13090 X-RAY SHIELDING
SECTION 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS
SECTION 15330 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION
SECTION 15405 PLUMBING, HOSPITAL

c. Drawings - Write In Changes.

On Seq. 079 Add the following notes:

5. Above ceiling ensure all gyp board joints are staggered and taped and nail/screws holes are filled with joint compound.

6. Seal all penetrations above ceiling with compressible fire safing materials.

d. Drawings - Reissued.

The drawings listed below shall be voided and the attached new drawings of the same number, each bearing the notation "AM #2", shall be substituted therefor:

Seq 023 ES1.1 ELECTRICAL AND COMMUNICATIONS SITE PLAN
Seq 024 A1.1 OVERALL FLOOR PLAN
Seq 079 A6.1 INTERIOR DETAILS
Seq 109 S2.1 FOUNDATION PLAN - AREA A
Seq 112 S3.2 FLOOR FRAMING AND FOUNDATION DRAIN PLAN - AREA B
Seq 119 S6.2 FOUNDATION DETAILS
Seq 191 E4.1 PANELBOARD SCHEDULES

ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 02221

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM D 1556-\	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
\-ASTM D 1557-\	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort 2,700 kN-m/cu.m.
\-ASTM D 2216-\	(1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
\-ASTM D 2487-\	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
\-ASTM D 2922-\	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 2937-\	(1994) Density of Soil in Place by the Drive-Cylinder Method
\-ASTM D 3017-\	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 4318-\	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

1.2.1 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 approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The

following shall be submitted in accordance with Section \=01300=\ SUBMITTAL PROCEDURES:

SD-09 Reports\

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 include materials classified in \-ASTM D 2487-\ as GC, GM, GW, GP, SC, SM, SP, SW, CL, and CH and shall be free of trash, debris, roots or other organic matter, or stones larger than 75 mm in any dimension.

2.1.2 Unsatisfactory Materials

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

2.1.3 Cohesionless and Cohesive Materials

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

2.1.4 NonExpansive Soils

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

2.2 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 37.5 mm and no more than 2 percent by weight shall pass the 4.75 mm size sieve.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

Clearing and grubbing is specified in Section \=02110=\ CLEARING AND GRUBBING.

3.2 TOPSOIL

Topsoil shall be stripped to a depth of 100 millimeters below existing grade within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

3.3 EXCAVATION

[AM#2] 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 1.5 m beyond the building line of each building and structure, excavation for outside grease interceptors, underground fuel tanks, and all work incidental thereto. Excavation shall extend a minimum of 1.5 meters beyond the building lines of each building or structure. ~~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.

3.4 DRAINAGE AND DEWATERING

3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites so as to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

3.4.2 Dewatering

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 900 mm 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 one meter below the working level.

3.5 SHORING

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

3.6 CLASSIFICATION OF EXCAVATION

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

3.7 BLASTING

Blasting will not be permitted.

3.8 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to secure the required slope and shall be tamped if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 150 mm below the bottom of the pipe, and the overdepth shall be backfilled with satisfactory material placed and compacted in conformance with paragraph FILLING AND BACKFILLING.

3.9 BORROW

[AM#2] Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials, including non-expansive soils for non-expansive fill, shall be obtained from off Government owned property at the Contractor's expense. ~~as specified in Section \=02225=\ EARTHWORK.~~

3.10 EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Section \=02225=\ EARTHWORK.

3.11 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. All soils shall be protected from slaking or other erosion resulting from ponding or flow of water.

3.12 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials. The surface shall be scarified to a depth of 150 mm 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 150 mm, 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 300 mm 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 plus or minus 3 percent of optimum moisture 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. The Contractor shall review the soils report prior to commencing earthwork and shall diligently follow the recommendations contained therein.

3.13 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 200 mm in loose thickness, or 150 mm when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade and shall include backfill for outside grease interceptors and underground fuel tanks. Backfill shall not be placed in wet or frozen areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 600 mm above sewer lines and 300 mm above other utility lines shall be free from stones larger than 25.4 mm 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 100 mm in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

	Percent Laboratory maximum density	
	Cohesive material	Cohesionless material
Non-Expansive Fill, embankment, and backfill		
Under structures, building slabs, steps, paved areas, around footings, and in trenches	90	95
Under sidewalks and grassed areas	85	90
Subgrade		
Under building slabs, steps, and paved areas, top 300 mm	90	95
Under sidewalks, top 150 mm	85	90

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

3.14 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with \-ASTM D 1556 or ASTM D 2922-\. When \-ASTM D 2922-\ is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in \-ASTM D 1556-\. \-ASTM D 2922-\ results in a wet unit weight of soil and when using this method \-ASTM D 3017-\ shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in \-ASTM D 3017-\. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer..

3.14.1 \+In-Place Densities+\

3.14.1.1 \+In-Place Density of Subgrades+\

One test per 200 square meters or fraction thereof.

3.14.1.2 \+In-Place Density of Fills and Backfills+\

One test per 200 square meters 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 152 millimeters in width, which are compacted with hand or hand-operated machines shall be

tested as follows: One test per each area less than 46 square meters, or one test for each 30 linear meter of long narrow fills 91 meters or more in length. If \-ASTM D 2922-\ is used, in-place densities shall be checked by \-ASTM D 1556-\ as follows: One check per lift for each 91 linear meters of long narrow fills, and a minimum of 2 checks per lift for other fill and backfill areas.

3.14.2 \+Moisture Content+\

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

3.14.3 \+Optimum Moisture and Laboratory Maximum Density+\

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 400 cubic meters of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

3.15 CAPILLARY WATER BARRIER

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

3.16 GRADING

Areas within 1.5 m outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

3.17 SPREADING TOPSOIL

Areas outside the building lines from which topsoil has been removed shall be topsoiled. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of 50 mm by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing 1.46 kN/m to 2.34 kN/m of roller. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

3.18 PROTECTION

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

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 02225

EARTHWORK

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 136-\	(1995a) Sieve Analysis of Fine and Coarse Aggregates
\-ASTM D 422-\	(1963; R 1990) Particle-Size Analysis of Soils
\-ASTM D 1140-\	(1992) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
\-ASTM D 1556-\	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
\-ASTM D 1557-\	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
\-ASTM D 2487-\	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
\-ASTM D 2922-\	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 2992-\	(1991) Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings
\-ASTM D 3017-\	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 4318-\	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by, \-ASTM D 2487-\ as GW, GM, GC, GP, SW, SM, SC, SP, CL and CH. Satisfactory materials for grading shall be free from roots and other organic matter, trash, debris, and frozen materials and stones larger than 150 mm in any dimension.

1.2.2 Unsatisfactory Materials

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

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in \-ASTM D 2487-\ as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of 0. Testing required for classifying materials shall be in accordance with \-ASTM D 4318-\, \-ASTM C 136-\, \-ASTM D 422-\, and \-ASTM D 1140-\.

1.2.4 Degree of Compaction

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

1.3 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 \=1300=\ SUBMITTAL PROCEDURES:

SD-08 Statements\

Earthwork\; *GA*\.

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

SD-09 Reports\

Testing\; *FIO*\.

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

SD-13 Certificates\

Testing\; *FIO*\.

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

SD-18 Records\

Earthwork\; *FIO*\.

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

1.4 SUBSURFACE DATA

Subsurface soil boring logs are included in the Contract Drawings. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.5 CLASSIFICATION OF EXCAVATION

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

1.6 UTILIZATION OF EXCAVATED MATERIALS

[AM#2] Unsatisfactory materials removed from excavations shall be disposed of ~~in designated waste disposal or spoil areas~~off-Government controlled property at the Contractor's expense. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. Newly designated waste areas on Government-controlled land shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, topsoil shall be stripped to a depth of 100 millimeters. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 50 mm in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be removed from the site.

3.2 EXCAVATION

[AM#2] The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Payment therefore will be in conformance with the "changes" clause of the CONTRACT CLAUSES. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of ~~in areas approved for surplus material storage or designated waste areas~~off-Government property at Contractor's expense. Unsatisfactory excavated material shall be ~~disposed of in designated waste or spoil areas~~hauled off post and disposed of at Contractor's expense. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of as shown or as directed, except that in no case shall material be deposited less than 1 meter from the edge of a ditch. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from approved sources, either private or within the limits of the project site. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR FILLS OR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR FILLS OR EMBANKMENTS, FILLS OR EMBANKMENTS, and RAW SUBGRADE PREPARATION, and Section \=02720=\ STORM-DRAINAGE SYSTEM; and Section \=02222=\ EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.6 PREPARATION OF GROUND SURFACE FOR FILLS OR EMBANKMENTS

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up to a depth of 150 mm; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of fill or embankment materials to assure adequate bond between fill or embankment material and the prepared ground surface.

3.7 FILLS OR EMBANKMENTS

3.7.1 Earth Fills Or Embankments

Earth fills or embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 75 mm. The material shall be placed in successive horizontal layers of loose material not more than 150 millimeters in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. The moisture content shall be at lease one percent above optimum during compaction. Compaction requirements for the upper portion of earth fills or embankments forming raw subgrade for pavements shall be identical with those requirements specified in paragraph RAW SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.8 RAW SUBGRADE PREPARATION

3.8.1 Construction

Raw subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 150 mm below finished grade for the raw subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire raw subgrade shall be shaped to line, grade, and cross section and compacted as specified. The elevation of the finish raw subgrade shall not vary more than 15 mm from the established grade and cross section.

3.8.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas, each layer of the embankment shall be compacted to at least 90 percent of laboratory maximum density.

3.8.2.1 Raw Subgrade for Pavements

Raw subgrade for pavements shall be compacted to at least the percentage of laboratory maximum density in the following table for the pavement shown.

Percentage of Laboratory Maximum Density Required

Fill	Cut

Cohesive Materials	Cohesionless Materials	Cohesive Materials	Cohesionless Materials
90	95	90	95

3.9 FINISHING

The surface of excavations, fills, embankments, and raw subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 30 mm of the grades and elevations indicated except that the degree of finish for raw subgrades shall be specified in paragraph RAW SUBGRADE PREPARATION. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials.

3.10 PLACING TOPSOIL

Topsoiling shall be spread as specified in Section 02920 TOPSOILING.

3.11 \+*TESTING*\+\

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. The first inspection be at the expense of the Government. Cost incurred for any subsequent inspections required because of failure of the first inspection will be charged to the Contractor. Field in-place density shall be determined in accordance with \-ASTM D 1556-\ or \-ASTM D 2922-\. When \-ASTM D 2922-\ is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in \-ASTM D 1556-\. \-ASTM D 2992-\ results in a wet unit weight of soil and when using this method \-ASTM D 3017-\ shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in \-ASTM D 3017-\; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements. Tests on recompacted areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.11.1 \+Fill and Backfill Material Gradation+\

One test per 1500 cubic meter stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with \-ASTM C 136-\.

3.11.2 \+In-Place Densities+\

a. One test per 1600 square meter, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 100 square meter, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

c. One test per 30 linear meters on all roadways..

3.11.3 \+Check Tests on In-Place Densities+\

If \-ASTM D 2922-\ is used, in-place densities shall be checked by \-ASTM D 1556-\ as follows:

| a. [AM#2 One check test per lift for each ~~8309~~500 square meter, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.

b. One check test per lift for each 500 square meter, of fill or backfill areas compacted by hand-operated machines.

3.11.4 \+Moisture Contents+\

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

3.11.5 \+Optimum Moisture and Laboratory Maximum Density+\

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 1500 cubic meter of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.11.6 \+Tolerance Tests for Raw Subgrades+\

Continuous checks on the degree of finish specified in paragraph RAW SUBGRADE PREPARATION shall be made during construction of the raw subgrades.

3.12 RAW SUBGRADE AND FILL OR EMBANKMENT PROTECTION

During construction, fills, embankments and excavations shall be kept shaped and drained. Ditches and drains along raw subgrade shall be maintained to drain effectively at all times. The finished raw subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, raw subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished raw subgrade will not be permitted. No subbase,

base course, ballast, or pavement shall be laid until the raw subgrade has been checked and approved, and in no case shall raw subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen raw subgrade.

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SECTION 02241

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 29-\	(1991a) Unit Weight and Voids in Aggregate
\-ASTM C 127-\	(1988; R 1993) Specific Gravity and Absorption of Course Aggregate
\-ASTM C 128-\	(1993) Specific Gravity and Absorption of Fine Aggregate
\-ASTM C 131-\	(1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
\-ASTM C 136-\	(1995a) Sieve Analysis of Fine and Coarse Aggregates
\-ASTM D 75-\	(1987; R 1992) Sampling Aggregates
\-ASTM D 422-\	(1963; R 1990) Particle-Size Analysis of Soils
\-ASTM D 1556-\	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
\-ASTM D 1557-\	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-1bf/cu. ft. (2,700 kN-m/cu. m.))
\-ASTM D 2167-\	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
\-ASTM D 2922-\	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 3017-\	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
\-ASTM D 4318-\	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

\-ASTM E 11-\ (1995) Wire-Cloth Sieves for Testing Purposes

TEXAS DEPARTMENT OF TRANSPORTATION

Standard Specifications for Construction of Highways, Streets and Bridges, 1993.

1.2 DEFINITIONS

1.2.1 Aggregate Base

Aggregate base as used herein is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

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

1.3 GENERAL

The work specified herein consists of the construction of an aggregate base course. The work shall be performed in accordance with this specification and shall conform to the lines, grades, notes and typical sections shown in the plans. Sources of all materials shall be selected well in advance of the time that materials will be required in the work.

1.4 SUBMITTALS

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

SD-01 Data\

Plant, Equipment, Machines, and Tools\; *FIO*\.

List of proposed equipment to be used in performance of construction work including descriptive data.

SD-09 Reports\

Sampling and Testing\; *FIO*\.

Field Density\; *FIO*\.

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 30 days before material is required for the work.

SD-18 Records\

Waybills and Delivery Tickets\; *FIO*\.

Coarse Aggregate\; *FIO*\.

Copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all materials actually used. A notification stating which type of coarse aggregate is to be used.

1.5 *WAYBILLS AND DELIVERY TICKETS*\

Copies of waybills or delivery tickets shall be submitted during the progress of the work. Before the final payment is allowed, waybills and certified delivery tickets shall be furnished for all aggregates actually used in the construction.

1.6 WEATHER LIMITATIONS

Base shall not be constructed when the atmospheric temperature is less than 2 degrees C. Base shall not be constructed on subgrades that are frozen or contain frost. If the temperature falls below 2 degrees C, completed areas shall be protected against any detrimental effects of freezing.

1.7 *PLANT, EQUIPMENT, MACHINES, AND TOOLS*\

1.7.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in satisfactory working condition at all times. Other compacting equipment may be used in lieu of that specified, where it can be demonstrated that the results are equivalent. The equipment shall be adequate and have the capability of producing the results specified.

1.7.2 Steel-Wheeled Rollers

Steel-wheeled rollers shall be the self-propelled type weighing not less than 9 metric tons, with a minimum weight of 135 kilograms per millimeter width of rear wheel. Wheels of the rollers shall be equipped with adjustable scrapers. The use of vibratory rollers is optional.

1.7.3 Pneumatic-Tired Rollers

Pneumatic-tired rollers shall have four or more tires, each loaded to a minimum of 13,600 kilograms and inflated to a minimum pressure of 1035 kPa. The loading shall be equally distributed to all wheels, and the tires shall be uniformly inflated. Towing equipment shall also be pneumatic-tired.

| 1.7.4 [AM#2] DELETED _____.

1.7.5 Sprinkling Equipment

Sprinkling equipment shall consist of tank trucks, pressure distributors, or other approved equipment designed to apply controlled quantities of water uniformly over variable widths of surface.

1.7.6 Tampers

Tampers shall be of an approved mechanical type, operated by either pneumatic pressure or internal combustion, and shall have sufficient weight and striking power to produce the compaction required.

1.7.7 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 3.66 meter straightedge for each bituminous paver, for use in the testing of the finished surface. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to ensure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.8 STOCKPILING MATERIALS

Materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at locations designated. Before stockpiling of material, storage sites shall be cleared, and sloped to drain. Materials obtained from different sources shall be stockpiled separately.

1.9 *SAMPLING AND TESTING*\

1.9.1 General Requirements

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing shall be permitted until the facilities have been inspected and approved. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the facilities to pass the first inspection will be charged to the Contractor. Tests shall be performed in sufficient numbers and at the locations and times directed to insure that materials and compaction meet specified requirements. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of tests.

1.9.2 Test Results

Results shall verify that materials comply with this specification. When a material source is changed, the new material will be tested for compliance. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced or modified as directed by the Contracting Officer.

1.9.3 Sampling

Aggregate samples for laboratory tests shall be taken in accordance with \-ASTM D 75-\.

1.9.4 Sieve Analysis

Before starting work, at least one sample of material shall be tested in accordance with \-ASTM C 136-\ and \-ASTM D 422-\ on sieves conforming to \-ASTM E 11-\. After the initial test, a minimum of one analysis shall be performed for each 1000 metric tons of material placed, with a minimum of three analyses for each day's run until the course is completed.

1.9.5 Liquid Limit and Plasticity Index

One liquid limit and plasticity index shall be performed for each sieve analysis. Liquid limit and plasticity index shall be in accordance with \-ASTM D 4318-\.

1.9.6 Laboratory Density

Tests shall provide a moisture-density relationship for the aggregate. Tests shall be conducted in accordance with \-ASTM D 1557-\.

1.9.7 Weight Per Cubic Meter of Slag

Weight per cubic meter of slag shall be determined in accordance with \-ASTM C 29-\.

1.9.8 Wear Tests

| [AM#2] Wear tests shall be performed in accordance with \-ASTM C 131-\.
| One test shall be run per ~~2500~~ 250 square meters of completed base course. A minimum of one test per aggregate source shall be run.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates

Aggregates shall consist of crushed stone or slag, crushed gravel, angular sand, or other approved material. Aggregates shall be durable and sound, free from lumps of clay, organic matter, objectionable coatings, and other foreign material. Material retained on a 4.75 mm sieve shall be known as coarse aggregate and that passing the 4.75 mm sieve shall be known as binder material.

2.1.1.1 *Coarse Aggregate*\

Only one type of coarse aggregate shall be used on the project. Coarse aggregates, consisting of angular fragments of uniform density and quality, shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested in accordance with \-ASTM C 131-\. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3, and an elongated particle is one having a ratio of length to width greater than 3.

a. Crushed Gravel: Crushed gravel shall be manufactured from gravel particles 50 percent of which by weight are retained on the maximum size gradation sieve specified.

b. Crushed Stone: Crushed stone retained on each sieve specified shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are adjacent, the angle between the planes of the fractures must be at least 30 degrees to count as two fractured faces.

2.1.1.2 Slag

Slag shall be an air-cooled blast-furnace product having a dry unit weight of not less than 1045 kg/cubic meter.

2.1.2 Binder Material

Binder material shall consist of screenings, angular sand, or other finely divided mineral matter processed or naturally combined with the coarse aggregate. Liquid-limit and plasticity-index requirements shall apply to any component that is blended to meet the required gradation and shall also apply to the completed course. The portion of any component or of the completed course passing the 0.425 mm sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.1.3 Gradation

Requirements for gradation specified shall apply to the completed base course. The aggregates shall be continuously graded within the following limits:

Sieve Designation Square-Mesh Sieve*	Percentage by Weight Passing
44 mm	100
22 mm	65 - 90
9.5 mm	50 - 70
4.25 mm	35 - 55
0.425 mm	15 - 30

*The table is based on aggregates of uniform specific gravity and the percentages passing the various sieves are subject to appropriate corrections in accordance with ASTM C 127 and C 128 when aggregates of "varying specific gravity are used. The gradation above conforms to Texas Department of Transportation Standard Specification for base course, Item 247, Type A, Grade 1.

(a) Particles having diameters less than 0.02 millimeter shall not be in excess of 3 percent by weight of the total sample tested.

(b) The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves are subject to appropriate

correction in accordance with \-ASTM C 127-\ and \-ASTM C 128-\ when aggregates of varying specific gravities are used.

(c) Gradation test shall be performed once per 2300 square meters on completed base course.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the base is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

Aggregate sources shall be cleared, stripped and excavated to working depths in a manner that produces excavation faces that are as nearly vertical as practicable for the materials being excavated. Strata of unsuitable materials overlying or occurring in the deposit shall be wasted. Methods of operating aggregate sources and the processing and blending of the materials may be changed or modified if necessary to obtain material conforming to the specified requirements. Upon completion of the work, aggregate sources shall be conditioned to drain readily and be left in a satisfactory condition. Aggregates shall be obtained from off-site sources.

3.3 PREPARATION OF UNDERLYING COURSE

3.3.1 General Requirements

Before constructing aggregate base course, the previously constructed underlying course shall be cleaned of foreign substances. Surface of underlying course shall meet the specified compaction and surface tolerances. Subgrade shall conform to Section \=02225=\ EARTHWORK. Ruts or soft, yielding spots that may appear in the underlying course, areas having inadequate compaction, and deviations of the surface from requirements specified shall be corrected. For cohesionless underlying materials containing sands, sand gravels, or any other cohesionless material in harmful quantities, the surface shall be mechanically stabilized with aggregate prior to placement of the aggregate course. Stabilization may be accomplished by mixing base course material into the underlying course and compacting by approved methods. Properly compacted material will be considered as part of the underlying course and shall meet all requirements for the underlying course. Finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until base course is placed.

3.3.2 Grade Control

Underlying material shall be excavated to sufficient depth for the required base course thickness so that the finished base course with the subsequent surface course will meet the fixed grade. Finished and completed area shall conform to the lines, grades, cross section, and dimensions indicated.

3.4 INSTALLATION

3.4.1 Mixing and Placing

Materials shall be mixed by the stationary plant, traveling plant, or road mix method and placed in such a manner as to obtain uniformity of the aggregate base course material and at a uniform optimum water content for compaction. The Contractor shall make such adjustments in mixing or placing procedures or in equipment to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to ensure a satisfactory base course.

3.4.2 Edges of Base Course

Approved material shall be placed along edges of aggregate base course in such quantities as will compact to thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 300 mm width of the shoulder to be rolled and compacted simultaneously with rolling and compacting of each layer of base course.

3.4.3 Compaction

Each layer of aggregate base course including shoulders shall be compacted. Water content shall be maintained at optimum. Density of compacted mixture shall be as shown on the plans. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. Areas inaccessible to the rollers shall be compacted with mechanical tampers, and shall be shaped and finished by hand methods.

3.4.4 Layer Thickness

Compacted thickness of the aggregate course shall be as indicated. No layer shall be in excess of 200 mm nor less than 75 mm in compacted thickness.

3.4.5 Proof Rolling

Proof rolling of the areas indicated shall be in addition to the compaction specified and shall consist of the application of 30 coverages with a heavy pneumatic-tired roller having four or more tires, each loaded to a minimum of 13,600 kg and inflated to a minimum of 1035 kPa. In areas designated, proof rolling shall be applied to the top lift or layer on which base course is laid and to each layer of base course. Water content of the top lift or layer on which base course is laid shall be maintained at optimum or at percentage directed from start of compaction to completion of proof rolling of that layer. Water content of each layer of the base course shall be maintained at the optimum percentage directed

from start of compaction to completion of proof rolling. Materials in base course or underlying materials that produce unsatisfactory results by rolling shall be removed and replaced with satisfactory materials and recompacted.

3.4.6 Finishing

The surface of the top layer shall be finished to grade and cross section shown. Finished surface shall be of uniform texture. Light blading during compaction may be necessary for the finished surface to conform to the lines, grades, and cross sections. Should the surface for any reason become rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portion shall be scarified, reworked, recompacted, or replaced as directed.

3.4.6.1 Smoothness

Surface of each layer shall show no deviations in excess of 9.5 mm when tested with the 3.66 meter straightedge. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting, as directed.

3.4.6.2 Thickness Control

Compacted thickness of the base course shall be within 12.7 mm of the thickness indicated. Where the measured thickness is more than 12.7 mm deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 12.7 mm thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within ^7 mm of the thickness indicated.

3.5 FIELD QUALITY CONTROL

3.5.1 \+*Field Density*\+\

| [AM#2] Field in-place density shall be determined in accordance with \-ASTM D 1556-\ or \-ASTM D 2922-\. When \-ASTM D 2922-\ is used, the calibration curves shall be checked, and adjusted if necessary, using the sand cone method as described in paragraph Calibration of the ASTM publication. \-ASTM D 2922-\ results in a wet unit weight of soil, and when using this method, \-ASTM D 3017-\ shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in \-ASTM D 3017-\. If \-ASTM D 2922-\ is used, in-place densities shall be checked by \-ASTM D 1556-\ at least once per lift for
| each ~~1600~~ 500 square meter of base material. Calibration curves and calibration test results shall be furnished within 24 hours of the conclusion of the tests. At least one field density test shall be performed for each 830 square meters of each layer of base material.

3.5.2 \+Smoothness+\

Measurements for deviation from grade and cross section shown shall be taken in successive positions parallel to the road centerline with a ^3

3.5 meter straightedge. Measurements shall also be taken perpendicular to the road centerline at 15 meter intervals.

3.5.3 \+Thickness+\

Thickness of the base course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square meters of base course. Measurements shall be made in ^75 mm diameter test holes penetrating the base course.

3.6 TRAFFIC

Completed portions of the area may be opened to traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.7 MAINTENANCE

The aggregate base course shall be maintained in a satisfactory condition until accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Removed in-place materials that are unsuitable for the base course material that is removed for the required correction of defective areas, and waste material and debris shall be disposed of as directed in waste disposal areas indicated.

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SECTION 02384

DRILLED PIERS

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 615-\	(1994) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

1.2 QUALIFICATIONS

The work shall be performed by a specialty Contractor, specializing in the specified foundation system and having experience installing the specified foundation system under similar subsurface conditions.

1.3 SUBSURFACE DATA

Subsurface soil boring locations are shown on the drawings. Copies of the subsurface investigation report are available at the office of Trinity Engineering Testing Corporation; 2772 West Commerce Street, Dallas, TX 75222; Phone 214-688-1803; Fax 214-688-1803; Metro 972-263-0487.

1.4 MEASUREMENT AND PAYMENT

1.4.1 Drilled Piers

Drilled foundation piers will be measured by the linear meter for depths actually drilled in strict conformance to the requirements of the specification and drawings. The length of drilled piers will be measured from the authorized bottom of the shaft to their upper termination at the bottom of the grade beam, pier cap, or any formed portion of the pier above grade, as applicable. Payment for drilled foundation piers will be made at the applicable contract unit price per linear meter according to diameter. This payment shall constitute full compensation for all plant, labor, materials, and all costs necessary for drilling, casing, and furnishing and placing steel and concrete, complete.

1.5 SUBMITTALS

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

SD-01 Data\

Drilled Piers\; *FIO*\.

A certified copy of the survey. Lines and levels shall be established and caisson centerline locations staked and maintained by a registered surveyor or engineer provided by the Contractor.

SD-08 Statements\

Qualifications\; *FIO*\.

Qualifications of the foundation system Contractor shall show that he has been engaged in the successful installation of drilled foundation caissons or piers for at least 5 years.

SD-18 Records\

Drilled Piers\; *FIO*\.

Detailed records in an approved form, for each pier, showing shaft diameters, depths of test holes, top and bottom elevations, bearing strata description, casing description, water conditions, concrete strength, concrete volume, rock elevations, dates of excavation and concrete placement, and other pertinent information. Upon completion of pier work, the Contractor shall provide a record of centerline locations based on the survey of the registered surveyor or engineer provided by the Contractor. In addition, corrective measures shall be similarly recorded. A complete tabulation of all records pertaining to approved piers shall be delivered to the Contracting Officer.

1.6 SUPERVISION, INSPECTION, AND SAFETY

1.6.1 Contractor Supervision

The Contractor shall provide for the supervision of all phases of drilled pier construction. Supervision shall be the Contractor's responsibility as outlined in Quality Control provisions of Section \=01440=\ CONTRACTOR QUALITY CONTROL. Each drilled pier excavation shall be checked by the Contractor for its depth, water removal, cleanup, workmanship, and for all tolerance requirements before any concrete is placed.

1.6.2 Government Inspection

The Contracting Officer reserves the right to inspect each drilled pier excavation prior to placement of reinforcing steel and concrete. The Contractor shall furnish the Contracting Officer all necessary equipment required for proper inspection of drilled pier excavations. This inspection in no way relieves the Contractor of his responsibilities as outlined in CONTRACT CLAUSE "INSPECTION OF CONSTRUCTION."

1.6.3 Safety Precautions for Workmen and Inspectors

The Contractor shall provide and operate all equipment required by the Contracting Officer to allow visual inspection of pier excavations by workmen or the Government, including equipment for personnel entering the excavation. Sufficient approved equipment shall be maintained to raise and lower Contractor and Government personnel into the excavation whenever required. All such equipment and all procedures used for personnel entering pier excavations shall strictly comply with all requirements of the applicable safety manuals.

1.6.3.1 Life Line

Each person entering a drilled pier excavation shall be provided with a life line rigged so that the person can be immediately hoisted out of the excavation in an emergency. The life line shall be suitable for instant rescue, securely fastened to a shoulder harness, and separated from any line used to remove excavated materials. No person shall be lowered into a drilled pier excavation prior to casing the shaft through the overburden.

1.6.3.2 Ventilation

Each drilled pier excavation shall be provided with a ventilating device of sufficient capacity to assure a safe and healthy atmosphere before workmen and inspectors are permitted to enter the drilled pier excavation and during all work periods.

PART 2 - PRODUCTS

2.1 CONCRETE WORK

Concrete work shall be in accordance with requirements of Section \=03300=\ CONCRETE FOR BUILDING CONSTRUCTION, as modified herein:

2.1.1 Coarse Aggregate

Maximum size of coarse aggregate shall be 20 mm .

2.1.2 Reinforcing Steel

Reinforcing steel shall conform to \-ASTM A 615-\ Grade 60. Steel shall be tied into cages and inserted securely in the drilled pier shaft, in position and alignment, as shown, prior to concrete placement.

2.1.3 Strength

Concrete strength shall be 21 MPa at 28 days. Slump shall be not less than 125 mm nor more than 175 mm.

2.1.4 Air Content

Air content shall be from 3 to 5%.

PART 3 - EXECUTION

3.1 PREPARATION

a. Excavation of piers or groups of piers shall be performed so that the excavation and the placement of reinforcing steel and concrete are a continuous operation performed the same day that the excavation is started. Excavations shall not be left open overnight. Drilled piers shall be excavated to the depths and dimensions shown in the drawings. The bottoms of the pier excavation shall be cleaned of loose and disturbed materials or materials determined to be unsatisfactory for the required bearing pressure. Excavated material shall be disposed of in accordance with Section \=02221=\ EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS AND STRUCTURES. Excavations below indicated depths, without specific direction by the Contracting Officer, shall be filled with concrete at no cost to the Government. Where, in the opinion of the Contracting Officer, materials are encountered at the indicated depths that do not provide the required bearing capacity or would result in unsatisfactory construction, the excavation shall be extended as directed by the Contracting Officer. Payment for the additional excavation and pier construction will be in accordance with PART 1 paragraph MEASUREMENT AND PAYMENT.

b. The drilling equipment shall be of suitable type and of sufficient size and capacity to satisfactorily perform the required drilling operations as specified or indicated. Heavy equipment shall be required to construct the piers in limestone. Minimum torque and crowd for drilling equipment shall be 68 000 Newton-meters and 134 000 Newtons respectively. All equipment shall be subject to specific approval by the Contracting Officer. Any equipment which fails to perform satisfactorily shall be immediately modified as approved or removed and replaced.

3.2 INSTALLATION

a. [AM#2] During construction, the pier excavation shall be adequately and securely protected against cave-ins, displacement of the surrounding earth, and inflow of ground and surface water by means of temporary steel casings as required or as directed by the Contracting Officer. Casings shall have outside diameters not less than indicated shaft sizes, and shall be capable of sustaining loads imposed by installing, sealing, maintaining the excavated hole, and extracting. The casing shall have a minimum wall thickness of 6.4 mm. The ends of the casing shall not be damaged such that proper seating and sealing are impaired. Damaged casing shall be immediately repaired or removed from the site. Temporary steel casings shall be withdrawn, as the concrete is being placed, maintaining sufficient head of concrete within the casing to offset water table and to prevent extraneous material from falling in from the sides or entering from beneath casing and mixing with concrete. Casings may be jerked upward a maximum of 100 mm to break the bottom seal but shall thereafter be removed with a smooth, continuous motion. All voids surrounding the casing shall be filled with concrete extruded from the bottom of the casing as it is being raised, with all free water surrounding the casing being forced to the surface ahead of the rising concrete. Venting shall be provided if necessary to insure removal of water around the casing as the concrete level rises, and the casing is being removed. Driving of casings shall not be permitted within 6 meters of concrete placed within the preceding 3 days. Temporary steel casings for each size pier shall be on site prior to starting any drilling.

b. The inside of steel casings shall be thoroughly cleaned before being placed in a pier hole.

c. Pier holes shall be protected from inflow of ground or surface water. Water that flows into the excavations shall be continuously removed and the maximum permissible depth of water in the bottom of excavation will be 50 mm at the start of concrete placement. In the event that excessive water enters the hold, the excavation shall be deepened to undisturbed material immediately prior to concrete placement.

e. Concrete shall be placed in the pier hole within three hours after approval of the completed excavation. Concrete shall be continuously placed by methods that insure against segregation and dislodging of excavation sidewalls and shall completely fill the bell and shaft. Concrete shall be placed by pumps, tremie, or drop chutes. The discharge of pumping chute shall be kept a minimum of 75 mm below the fresh concrete surface during placement.

f. Concrete shall be vibrated for not less than the upper 1.5 meters of pier.

g. Protection shall be provided around the top of the excavation to prevent debris and water from entering the excavation and concrete placed therein.

3.3 TOLERANCES

a. Any pier out of center or plumb beyond the tolerance specified shall be corrected as necessary to comply with the tolerances and the Contractor shall bear any cost of correction. Method of correction shall be approved by the Contracting Officer.

b. Cross sections of shafts shall not be less than design dimensions. Cross sections of shafts shall not be greater than design dimensions plus 75 mm unless approved or directed by the Contracting Officer.

c. Location of the tops of installed piers shall not deviate from the centerline locations shown on the drawings more than 75 mm .

| d. [AM#2] Vertical piers shall be installed plumb within a maximum
| of 35 mm for the first 3 meters and within ~~35~~13 mm for each 3 meters of additional depth.

e. The center of the pier will be established after construction is completed and the center marked by a suitable permanent mark.

3.4 PROTECTION

Provide protection around top of the excavation to prevent debris from being dislodged into the excavation and concrete.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 02516

CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 184-\	(1990) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
\-ASTM A 185-\	(1990a) Steel Welded Wire Fabric, Plain.
\-ASTM A 497-\	(1990b) Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
\-ASTM A 615-\	(1992b) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
\-ASTM A 616-\	(1992) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
\-ASTM A 617-\	(1992) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.
\-ASTM D 1751-\	(1983; R 1991) Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
\-ASTM D 1752-\	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
\-ASTM D 2828-\	(1971; R 1981) Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type.

CORPS OF ENGINEERS (COE)

\-COE CRD-C 572-\	(1974) Polyvinylchloride Water Stop.

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The

following shall be submitted in accordance with Section \=01300=\ SUBMITTAL DESCRIPTIONS.

SD-09 Reports\

Concrete Strength and Other Tests\; *FIO*\.

The Contractor shall furnish concrete strength and other tests in accordance with the testing procedures specified in PART 3 paragraph CONTRACTOR QUALITY CONTROL.

PART 2 - PRODUCTS

2.1 GENERAL

Materials and concrete work for concrete pavement shall conform to the requirements of the Section \=03300=\ CONCRETE FOR BUILDING CONSTRUCTION except as otherwise specified herein or shown on the drawings. All pavement concrete shall have 45 MPa flexural strength at 28 days.

2.2 JOINT FILLER

2.2.1 For Expansion Joints

Filler shall be preformed materials conforming to \-ASTM D 1751-\ or \-ASTM D 1752-\.

2.2.2 For Contraction Joints

Sawable type contraction joint inserts shall conform to \-ASTM D 2828-\. Nonsawable contraction joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of \-ASTM D 2828-\, with the exception of Section 3.4, "Resistance to Sawing." PVC inserts shall conform to \-COE CRD-C 572-\.

2.3 DOWELS

Dowels shall be plain steel bars conforming to \-ASTM A 615-\, grade 40 or 60; \-ASTM A 616-\, grade 50 or 60; or \-ASTM A 617-\, grade 40 or 60.

2.4 TIE BARS

Tie bars shall be deformed steel bars conforming to \-ASTM A 615-\, \-ASTM A 616-\, or \-ASTM A 617-\, and of the sizes and dimensions indicated. Deformed rail steel bars and high-strength billet or axle steel bars, grade 60 or higher, shall not be used for bars that are bent and straightened during construction.

2.5 REINFORCEMENT

All reinforcement shall be free from loose flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete. Removal of thin powdery rust and tight rust is not required. However, reinforcing steel which is rusted to the extent that it does not conform to the required dimensions or mechanical properties shall not be used.

2.5.1 Bar mats shall conform to \-ASTM A 184-\. The bar members shall be billet, rail, or axle steel, Grade 60.

2.5.2 Welded steel wire fabric shall conform to \-ASTM A 185-\.

2.5.3 Welded deformed steel wire fabric shall conform to \-ASTM A 497-\.

PART 3 - EXECUTION

3.1 JOINTS

Joints shall conform to the details indicated and shall be perpendicular to the finished grade of the pavement. Transverse expansion and contraction joints shall be straight and continuous from edge to edge of the pavement.

3.1.1 Construction Joints

3.1.1.1 Longitudinal Construction Joints

Longitudinal construction joints between paving lanes shall be located as indicated. Dowels, keys or keys and tie bars shall be installed in the longitudinal construction joints or the edges shall be thickened as required and as indicated. When the concrete is placed using stationary forms, metal forms securely fastened to the concrete form shall be used to form the keyway in the plastic concrete. The dimensions of the keyway forms shall not vary more than plus or minus 3 mm from the dimensions indicated and shall not deviate more than plus or minus 6 mm from the mid-depth of the pavement. Longitudinal construction joints shall be edged and subsequently sawed to provide a groove at the top conforming to the details and dimensions indicated.

3.1.1.2 Transverse Construction Joints

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for 30 minutes or longer. Insofar as practicable, transverse construction joints shall be installed in the location of a planned joint. When concrete placement cannot be continued, the transverse construction joint may be installed within the slab unit but not less than 3050 mm from a planned transverse joint. Transverse construction joints shall be doweled as shown. When the construction joint is located at planned transverse joints, one half of each dowel shall be painted and oiled to permit movement at the joint. These joints shall be edged and subsequently sawed to provide a groove at the top conforming to the details and dimensions indicated. When a construction joint is installed within a slab unit, the dowel bars shall not be painted or oiled, and no groove shall be provided at the joint. When concrete placing is resumed, the planned joint spacing shall be used beginning with the first regularly scheduled transverse joint.

3.1.2 Expansion Joints

Expansion joints shall be formed by means of preformed filler material. The filler shall be securely held in position by means of approved metal supports which shall remain in the pavement. A removable metal channel cap bar shall be used to hold the parts of the joint in proper position

and protect the filler from damage during concreting operations. The cap bar shall be removable without damage to the pavement to provide a space for sealing of the joint. Adjacent sections of filler shall be fitted tightly together and the filler shall extend across the full width of the paving lane in order to prevent entrance of concrete into the expansion space. Expansion joints shall be formed about structures and features that project through, into, or against the pavement, using joint filler of the type, thickness, and width indicated, and installed in such manner as to form a complete, uniform separation between the structure and pavement.

3.1.3 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type, and shall be constructed as indicated. Longitudinal contraction joints shall be constructed by sawing a groove in the hardened concrete with a power-driven saw in conformance with paragraph "Sawed Joints" below, unless otherwise approved. Transverse contraction joints shall be constructed in conformance with requirements for sawed joints or insert-type joints, unless otherwise approved.

3.1.3.1 Sawed Joints

Sawed joints shall be constructed by sawing a groove in the concrete with a 3 mm blade to the full depth as indicated. After expiration of the curing period, the upper portion of the groove shall be widened by sawing to the width and depth indicated. The time of sawing shall be varied, depending on existing and anticipated weather conditions, and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The sawed faces of joints will be inspected for undercutting or washing of the concrete due to the early sawing, and sawing shall be delayed if undercutting is sufficiently deep to cause structural weakness or excessive roughness in the joint. The sawing operation shall be carried on as required during both day and night regardless of weather conditions. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. A chalk line or other suitable guide shall be used to mark the alinement of the joint. The saw cut shall not vary more than 13 mm from the true joint alinement. Before sawing a joint, the concrete shall be examined closely for cracks, and the joints shall not be sawed if a crack has occurred near the joint location. Sawing shall be discontinued when a crack develops ahead of the saw cut. Workmen and inspectors shall wear clean, rubber-soled footwear, and the number of persons walking on the pavement shall be limited to those actually performing the sawing operation. Immediately after joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. Any membrane-cured surface damaged during the sawing operations shall be resprayed as soon as the surface becomes dry. The sawing equipment shall be adequate in number of units and power to complete the sawing at the required rate. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operation.

3.1.3.2 Insert-Type Contraction Joints

Insert type contraction joints shall be constructed by installation of a preformed insert in the plastic concrete to form a weakened plane to induce cracking. The insert materials shall conform to \-ASTM D 2828-\, or \-COE CRD-C 572-\, whichever is applicable. Inserts shall be constructed so that the insert material can be removed to form a groove in the concrete as required. All types of inserts shall be approved prior to installation. Inserts shall be furnished in heights for the various depths of joints shown and in lengths equal to the width of the paving lane.

3.1.3.2.1 Equipment

Equipment for installing inserts shall be a machine equipped with a vibratory bar for cutting a groove in the plastic concrete for placement of the insert or for vibrating the insert into place at the prescribed joint location. Installation of the insert shall be to the required depth throughout the full width of the paving lane. The vibration units shall be so arranged that the vibration will be uniformly distributed throughout the bar. The intensity of vibration shall be adjustable as necessary to form a groove of proper size for the filler or forcing the insert into the plastic concrete and for consolidating the concrete around the in-place insert. The vibratory float shall be used following the placement of the insert material in lieu of hand floating or troweling the finish.

3.1.3.2.2 Installation of Inserts

The insert shall be installed in the plastic concrete immediately following the final machine finishing with a maximum of two joint spacings between finishing machine and inserter. Additional straightedge and texturing operations shall be accomplished without disturbing the installed insert. Adjacent sections of the joint inserts within each slab unit shall be securely joined together and the insert shall extend across the full width of the slab. The concrete shall be thoroughly consolidated against and for the full depth of the insert. The insert shall be perpendicular to the finished grade of the pavement and shall be straight in alinement at the prescribed joint locations shown, with the top of the inset flush or not more than 3 mm below the pavement surface. The insert equipment shall be available on the job in good condition prior to placement of concrete to insure proper vibration and floating.

3.1.3.2.3 Grooving Operations

After the expiration of the curing period a groove for joint sealer shall be formed as specified below. The top portion of fiberboard fillers or sawable preformed inserts shall be removed by sawing with a power saw to form a groove of required dimensions. The sawing shall be so accomplished as to abrade the concrete surfaces in the joint groove and remove all traces of the filler or insert. Nonsawable insert material shall be removed as prescribed by the manufacturer. The dimensions and characteristics of the groove thus formed shall be as shown on the plans. The grooves shall have edges free of ravels and spalls. The grooves shall be straight from edge to edge of the pavement and shall not vary more than 13 mm from alinement.

3.1.4 Sealing Joints

Joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit, as directed. Sawing of filler-type joints shall be accomplished immediately before sealing of the joints. Joints shall be sealed as specified in Section \=02592=\ FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

3.1.5 Grooving and Sealing Cracks

Random cracks, except those specifically excluded by the Contracting Officer, that occur in the pavement during construction shall be grooved and sealed. The top of the crack shall be grooved to a depth of 19 mm and to a width not less than 10 mm nor more than 16 mm by means of an approved mechanical grooving machine. The grooving tool shall be capable of following closely the path of the crack and of widening the top of the crack to the required section without spalling or otherwise damaging the concrete. Loose and fractured concrete shall be removed, and the groove shall be thoroughly cleaned and completely filled with approved joint sealing material of the type required for the area in which the crack occurs. No separate payment will be made for grooving, cleaning, and sealing of cracks.

3.2 FINISH FOR PAVEMENT

The pavement shall be struck off to grade and immediately straightedged with a 3 meter straightedge in both directions. Floating shall be started after the surface has been straightedged and all the surface water has disappeared. The initial floating may be performed by use of power-driven equipment. The final surface texture of the pavement shall be provided by means of a burlap drag, or broom as approved.

3.2.1 Burlap-Drag Texture

Surface texture shall be applied by dragging the surface of the pavement, in the direction of the concrete placement, with an approved multiple-ply burlap drag at least three feet in width and equal in length to the width of slab. The leading transverse edge of the drag shall be securely fastened to a lightweight pole or travelling bridge, and at least 305 mm of the burlap shall be in contact with the pavement during dragging operation. The drag shall be operated with the burlap moist and the burlap shall be cleaned and changed as required. The dragging shall be done so as to produce a uniform finished surface having a fine sandy texture without disfiguring marks.

3.2.2 Broom Texturing

Surface texture shall be applied using an approved hand or mechanical stiff bristle broom of a type that will produce uniform corrugations. For hand brooming, the brooms shall have handles longer than half the width of slab to be finished. The hand brooms shall be drawn transversely across the surface from the centerline to each edge with slight overlapping strokes. For mechanical operations, the broom shall be operated with the length of the broom parallel to the pavement centerline. The broom shall be capable of traversing the full width of the pavement in a single pass at a uniform speed and with a uniform pressure. Successive passes of the broom shall be overlapped the minimum necessary to obtain a uniformly textured surface. Brooms shall be washed thoroughly and dried at frequent intervals during use. Worn or damaged brooms shall be removed

from the job site. Brooming should be completed before the concrete has dried to the point where the surface will be unduly torn or roughened, but after drying has progressed enough so that the mortar will not flow and attenuate the sharpness of the corrugations. The corrugations should be uniform in appearance and approximately 2 mm in depth but not more than 3 mm in depth.

3.3 SURFACE TEST

After the concrete curing period, the surface of the paving shall be tested with a straightedge or device which shall be operated in such manner as to reveal any irregularities. Any portion of the pavement which shows a variation or departure greater than 3 mm from the testing edge of a 3 meter straightedge, shall be removed and replaced or corrected as directed by the Contracting Officer.

3.4 CURING AND PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work by the Government. Traffic shall be excluded from the pavement until the concrete is at least 14 days old, or for a longer period if so directed by the Contracting Officer. Curing of concrete shall be as specified in the Section \=03300=\ CONCRETE FOR BUILDING CONSTRUCTION.

3.5 PAVEMENT THICKNESS

The pavement shall be constructed in accordance with the thickness shown on the drawings. No variation in thickness of over 6 mm will be permitted. If a variation in thickness occurs and, in the opinion of the Contracting Officer, is sufficient to seriously impair the service expected from the pavement, the deficient area shall be removed and replaced with a slab of quality and thickness satisfactory to the Contracting Officer. The Contracting Officer may allow the Contractor the choice of leaving the defective section in place and receiving no compensation or payment for same, or of removing and replacing the pavement as provided above.

3.6 INTEGRAL OR MONOLITHIC CURBS

Integral or monolithic curbs shall be constructed to the dimensions and at the locations indicated. Curbs shall be constructed of portland-cement concrete conforming with these specifications except as modified herein. The maximum nominal size of the coarse aggregate for curb construction shall be 38 mm .

3.6.1 Forms for Integral or Monolithic Curbs

Forms for the curbs shall be of similar material to that used for the pavements. The outside form shall be of a depth equal to the combined depth of the integral curb and pavement slab. The form may be a built-up section, the lower portion equal to the depth of the pavement slab and the upper portion equal to the depth of the integral curb. The built-up form shall be so designed as to assure rigid connection between the lower and upper portions. The inside curb-face form shall have a batter from the top of the curb to the finished pavement surface as indicated. The inside curb form shall be securely fastened to and supported by the outside form.

The fastenings shall be so designed as not to obstruct satisfactory finishing and edging of the top of the curb and to permit early removal of the face form.

3.6.2 Placing

3.6.2.1 The concrete curb shall be placed as soon as practical after the slab is placed but in no case shall the time between the placing of the slab and the placing of the curb exceed 45 minutes. The concrete shall be thoroughly spaded or vibrated until well compacted and until a good bond is obtained between the curb and the slab.

3.6.2.2 If it is impractical to complete the integral curb simultaneously with the pavement slab, deformed tie bars, 16 mm in diameter and 178 mm in length, shall be embedded vertically in the slab at 25 mm intervals and so as to extend 50 mm into the curb. While the slab is still green, the surface shall be dapped approximately 25 mm below the screeded surface for the full width of the curb leaving a recess with a roughened surface to provide bond for the curb section.

3.6.3 Transverse joints shall be of the type and construction specified for transverse joints for the pavement slab on which the curb is placed. Pavement joints shall extend through the curb with the exception that horizontal dowels will not be required between joints in the curb.

3.6.4 Finishing

The top of the curb shall be floated in such manner as to thoroughly compact the concrete and produce a smooth even surface. The edges of the curb and joints shall be rounded by using appropriate edging tools. Vertical edges of joints shall be dressed when the curb form is removed. While the concrete is green, the top and face of the curb shall be finished by rubbing the surface with a wood or concrete rubbing block and water until all blemishes, form marks, and tool marks have been removed. Ample water shall be used during the rubbing to avoid a plastered condition. The rubbed surface shall then be brushed with a fine-textured brush to obtain a uniform surface texture. The face of the finished curb shall be true and straight. The top surface of the curb shall be of uniform width, free from humps, sags, and other irregularities. The top and face of the curb shall not vary more than 3 mm from the edge of a 3 meter straightedge, except at grade changes or curves. Visible surfaces and edges of the finished curb shall be free of blemishes, form and tool marks, and shall be uniform in color, shape, and appearance.

| 3.7 [AM#2] FIELD QUALITY CONTROL
|
| 3.7.1 General Requirements
|
| The Contractor shall perform the inspection and tests described and meet
| the specified requirements for inspection details and frequency of
| testing. Based upon the results of these inspections and tests, the
| Contractor shall take the action and submit reports as required below, and
| any additional tests to insure that the requirements of these
| specifications as met.
|
| 3.7.2 Strength Testing
|

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each shall be taken not less than once a day nor less than once for every 40 cubic meters of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C31 by an approved testing laboratory. Each strength test shall be the average of two test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 4 Mpa.

3.7.3 Air Content

Air content shall be determined in accordance with ASTM C 173 or ASTM C 231. ASTM C 2310 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each day. Additionally tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.7.4 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 40 cubic meters, or fraction thereof, of concrete placed during each day. Additional tests will be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noticed along the edges of slip-formed concrete.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 02526

WHEEL STOPS

PART 1 - GENERAL

1.1 REFERENCES (Not Applicable)

1.2 SUBMITTALS

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

SD-01, Data\

Wheel Stops\; *FIO*\.

Furnish manufacturer's catalog data and drawings describing proposed molded thermoplastic wheel stops to be installed on the project.

SD-13, Certificates\

Wheel Stops\; *FIO*\.

Furnish manufacturer's written certification that wheel stops furnished for the project conform to the specified requirements.

PART 2 - PRODUCTS

2.1 WHEEL STOPS

Wheel stops shall be constructed of precast reinforced concrete or may be of molded thermoplastic construction.

2.1.1 Concrete Wheel Stops

Concrete wheel stops shall be constructed of reinforced concrete having a compressive strength of 24 MPa and 5.2 MPa flexural strength and conforming to the Section \=03300=\ CONCRETE FOR BUILDING CONSTRUCTION. The stops shall be constructed as detailed on the drawings, or may be approved manufactured items. If approved manufactured stops are used, installation shall be as recommended by the manufacturer and as approved.

| 2.1.2 [AM#2] DELETED _____.

PART 3 - EXECUTION

3.1 INSTALLATION

Wheel stops shall be installed as indicated and in the locations shown on the drawings. Stops will be inspected before installation and any damaged or defective stops shall be replaced.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 02551

BITUMINOUS PAVING FOR ROADS, STREETS AND OPEN STORAGE AREAS

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

-\ASTM C 117-\	(1990) Materials Finer than 75-micrometer (No 200) Sieve in Mineral Aggregates by Washing
\-ASTM C 127-\	(1988) Specific Gravity and Absorption of Coarse Aggregate
\-ASTM C 128-\	(1988) Specific Gravity and Absorption of Fine Aggregate
\-ASTM C 136-\	(1984a) Sieve Analysis of Fine and Coarse Aggregates
\-ASTM C 183-\	(1988) Sampling and the Amount of Testing of Hydraulic Cement
\-ASTM D 75-\	(1987) Sampling Aggregates
\-ASTM D 140-\	(1988) Sampling Bituminous Materials
\-ASTM D 2041-\	(1991) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
\-ASTM D 2172-\	(1992) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
\-ASTM D 2216-\	(1990) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
\-ASTM D 3515-\	(1989) Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

CORPS OF ENGINEERS (COE) HANDBOOK FOR CONCRETE AND CEMENT

\-COE CRD-C 649-\	(1995) Standard Test Method for Unit Weight, Marshall Stability, and Flow of Bituminous Mixtures.
\-COE CRD-C 650-\	(1995) Standard Test Method For Density And Percent Voids In Compacted Bituminous Paving Mixtures
\-COE CRD-C 652-\	(1992) Standard Test Method for Measurement of Reduction in Marshall Stability of Bituminous Mixtures caused by Immersion in Water

TEXAS STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION STANDARD SPECIFICATIONS: (TSDHPT)

\-TSDHPT-01-\	(1993) Standard Specification for Construction of Highways, Streets and Bridges.

1.2 SUBMITTALS

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

SD-09 Reports\

Bituminous Pavement\; *GA*\.

Copies of test results.

SD-14 Samples\

Bituminous Pavement\; *GA*\.

Samples of the materials in the quantities indicated below for the job mix formula.

Aggregate and mineral filler (if needed) to be blended in approximately the same proportions as used in the project	100 kg
Asphalt Cement	20 liters

Aggregate samples when new sources are developed, with a plan for operation, 45 days before starting production. Samples of the asphalt cement specified, not less than 45 days before production.

SD-18 Records\

Waybills and Delivery Tickets\; *GA*\.

Waybills and delivery tickets, during progress of the work.

1.3 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.3.1 General

The bituminous plant shall be of such capacity to produce the quantities of bituminous mixtures required. Hauling equipment, paving machines, rollers, miscellaneous equipment, and tools shall be provided in sufficient numbers and capacity and in proper working condition to place the bituminous paving mixtures at a rate equal to the plant output.

1.3.2 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 3.66 m straightedge for each bituminous paver. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.4 WEATHER LIMITATIONS

Unless otherwise directed, bituminous courses shall not be constructed when temperature of the surface of the existing pavement or base course is below 5 degrees C.

1.5 PROTECTION OF PAVEMENT

After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until the pavement has cooled to 60 degrees C.

1.6 GRADE AND SURFACE-SMOOTHNESS REQUIREMENTS

Finished surface of bituminous courses, when tested as specified below shall conform to gradeline and elevations shown and to surface-smoothness requirements specified.

1.6.1 Plan Grade

The grade of the completed surface shall not deviate more than 15.2 mm from the plan grade.

1.6.2 Surface Smoothness

When a 3.66 m straightedge is laid on the surface parallel with the centerline of the paved area or transverse from crown to pavement edge, the surface shall vary not more than 6.4 mm from the straightedge.

1.7 GRADE CONTROL

Lines and grades shall be established and maintained by means of line and grade stakes placed at site of work in accordance with the SPECIAL CLAUSES. Elevations of bench marks used by the Contractor for controlling pavement operations at the site of work will be determined, established, and maintained by the Government. Finished pavement elevations shall be established and controlled at the site of work by the Contractor in accordance with bench mark elevations furnished by the Contracting Officer.

1.8 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commerical testing laboratory or by the Contractor subject to approval. Unless otherwise specified sampling shall be in accordance with \-ASTM D 75-\ for aggregates, \-ASTM C 183-\ for mineral filler, and \-ASTM D 140-\ for bituminous material. Copies of test results shall be furnished to the Contracting Officer. Approval of a source does not relieve the Contractor of responsibility for delivery at the job site of materials meeting the requirements herein.

1.8.1 Tests Required

1.8.1.1 Plant Mix

1.8.1.1.1 Hot Bin Gradations

Hot bin gradations (cold-feed gradation when drum mix plant is used), shall be tested in accordance with \-ASTM C 136-\ and \-ASTM C 117-\. A minimum of one test will be conducted per every 181 metric tons of wearing course mix placed or fraction thereof, and a minimum of one test conducted per every 318 metric tons of intermediate course mix placed or fraction thereof.

1.8.1.1.2 Marshall Specimens

Marshall Specimens shall be taken in accordance with \-CRD-C 652-\. At least one set of specimens shall be taken per each 181 metric tons of wearing course mix placed, and one set of specimens shall be taken per each 318 metric tons of intermediate course mix placed. However, not less than two sets of specimens (three specimens per set) shall be taken in any one day regardless of the quantity of mix placed.

1.8.1.1.3 Asphalt Extractions

Asphalt extractions shall be performed in accordance with \-ASTM D 2172-\, Method A or B. At least one asphalt extraction shall be conducted per day.

1.8.1.2 Field Density Tests

Field Density Tests shall be conducted in accordance with \-CRD-C 650-\. A minimum of one test with two specimens per test shall be conducted per every 181 metric tons of wearing course mix placed or fraction thereof, and a minimum of one test conducted per every 381 metric tons of intermediate course mix placed or fraction thereof.

1.8.1.3 Thickness Measurements

| [AM#2] Thickness Measurements shall be taken at a minimum of one measurement
| for each ~~835~~500 square meters of mix placed.

1.9 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

1.9.1 Mineral Aggregates

Mineral aggregates shall be delivered to the site of the bituminous mixing plant and stockpiled in such manner as to preclude fracturing of aggregate particles, segregation, contamination, or intermingling of different materials in the stockpiles or cold-feed hoppers. Mineral filler shall be delivered, stored, and introduced into the mixing plant in a manner to preclude exposure to moisture or other detrimental conditions.

1.10 ACCESS TO PLANT AND EQUIPMENT

The Contracting Officer shall have access at all times to all parts of the paving plant for checking adequacy of the equipment in use; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking temperatures maintained in preparation of the mixtures.

1.11 *WAYBILLS AND DELIVERY TICKETS*\

Before the final statement is allowed, the Contractor shall file with the Contracting Officer certified waybills and certified delivery tickets for all aggregates and bituminous materials actually used in construction.

PART 2 - PRODUCTS

2.1 HOT-MIX SURFACE COURSE

Bituminous hot-mix surface course shall conform to the requirements of TSDHPT-01 for "Hot-Mix Asphaltic Concrete Pavement." Item 340, except as specified hereinafter.

2.1.1 Asphalt Material

Asphalt material for the surface course shall be asphalt cement AC-20 conforming to TSDHPT-01 for "Asphalts, Oils, and Emulsions", Item 300. Asphalt material shall come from a source approved for use by the TSDHPT. The seal number from the tank and the number of the TSDHPT laboratory test report shall be furnished to the Contracting Officer.

2.1.2 Paving Mixture

Paving mixture shall be Type "D".

2.1.3 State Specification Modifications

\-TSDHPT-01-\ Specification shall be modified as follows:

a. Material retained on the No. 10 screen shall not exceed 65 percent.

b. Density and stability requirements shall not apply.

c. Construction methods paragraph shall not apply.

d. The measurement and payment paragraphs shall not apply.

2.2 PROPORTIONING OF MIXTURE

2.2.1 Job Mix Formula (JMF)

The JMF for the bituminous mixture will be furnished to the Contracting Officer for approval. No payment will be made for mixtures produced prior to the approval of the JMF. The formula will indicate the percentage of each stockpile and mineral filler, the percentage of each size aggregate, the percentage of bitumen, and the temperature of the completed mixture when discharged from the mixer. The tolerances specified in the NMSHTD-01, Section 401, or TSDHPT-01, Item 340, will be allowed (as applicable) for asphalt content, temperature, and aggregate grading for tests conducted on the mix as discharged from the mixing plant. Bituminous mix that deviates more than 13.9 degrees C from the JMF shall be rejected. The JMF may be adjusted during construction to improve paving mixtures, as directed, without adjustments in the contract prices.

2.2.2 Test Properties of Bituminous Mixtures

Finished mixture shall meet requirements described below when tested in accordance with \-COE CRD-C 649-\. All samples will be compacted with 50 blows of specified hammer on each side of sample. When bituminous mixture fails to meet the requirements specified below, the paving operation shall be stopped until the cause of noncompliance is determined and corrected.

2.2.2.1 Stability, Flow, and Voids

Requirements for stability, flow, and voids are shown in TABLES I and II for nonabsorptive and absorptive aggregates, respectively.

TABLE I. NONABSORPTIVE-AGGREGATE MIXTURE

	Wearing Course	Intermediate Course
Stability minimum, Newtons	2200	
	2200	
Flow maximum, 25/100-millimeter units	20	
		20
Voids total mix, percent (1)	3-5	4-6
Voids filled with bitumen, percent (2)	75-85	65-75

(1) The Contracting Officer may permit deviations from limits specified when gyratory method of design is used to develop the JMF.

(2) The Contracting Officer may permit deviation from limits specified for voids filled with bitumen in the intermediate course in order to stay within limits for percent voids total mix.

TABLE II. ABSORPTIVE-AGGREGATE MIXTURE

	Wearing Course	Intermediate Course
Stability minimum, Newtons	2200	2200
Flow maximum, 25/100-millimeter units	20	
	20	
Voids total mix, percent (1)	2-4	3-5
Voids filled with bitumen, percent (2)	80-90	70-80

(1) The Contracting Officer may permit deviations from limits specified when gyratory method of design is used to develop the JMF.

(2) The Contracting Officer may permit deviation from limits specified for voids filled with bitumen in the intermediate course in order to stay within limits for percent voids total mix.

a. When the water-absorption value of the entire blend of aggregate does not exceed 2.5 percent as determined in accordance with \-ASTM C 127-\ and \-ASTM C 128-\, the aggregate is designated as nonabsorptive. The theoretical specific gravity computed from the apparent specific gravity or \-ASTM D 2041-\ will be used in computing voids total mix and voids filled with bitumen, and the mixture shall meet requirements in TABLE I.

b. When the water-absorption value of the entire blend of aggregate exceeds 2.5 percent as determined in accordance with \-ASTM C 127-\ and \-ASTM C 128-\, the aggregate is designated as absorptive. The theoretical specific gravity computed from \-ASTM D 2041-\ shall be used in computing percentages of voids total mix and voids filled with bitumen; the mixture shall meet requirements in TABLE II.

2.2.2.2 Stability

The index of retained stability must be greater than 75 percent as determined by \-COE CRD-C 652-\. When the index of retained stability is less than 75, the aggregate stripping tendencies may be countered by the use of hydrated lime or by treating the bitumen with an approved antistripping agent. The hydrated lime is considered as mineral filler and should be considered in the gradation requirements. The amount of hydrated lime or antistripping agent added to bitumen shall be sufficient, as approved, to produce an index of retained stability of not less than 75 percent. No additional payment will be made to the Contractor for addition of antistripping agent required.

PART 3 - EXECUTION

3.1 BASE COURSE CONDITIONING

The surface of the base course will be inspected for adequate compaction and surface tolerances specified in Section \=02241=\ AGGREGATE BASE COURSE. Unsatisfactory areas shall be corrected.

3.2 PREPARATION OF BITUMINOUS MIXTURES

Rates of feed of aggregates shall be regulated so that the moisture content and temperature of aggregates will be within specified tolerances. Aggregates, mineral filler, and bitumen shall be conveyed into the mixer in proportionate quantities required to meet the JMF. Mixing time shall be as required to obtain a uniform coating of the aggregate with the bituminous material. Temperature of bitumen at time of mixing shall not exceed 150 degrees C. Temperature of aggregate and mineral filler in the mixer shall not exceed 160 degrees C when bitumen is added. Overheated and carbonized mixtures or mixtures that foam shall not be used.

3.3 WATER CONTENT OF AGGREGATES

Drying operations shall reduce the water content of mixture to less than 0.75 percent. The water content test will be conducted in accordance with \-ASTM D 2216-\; the weight of the sample shall be at least 500 grams. If the water content is determined on hot bin samples, the water content will be a weighted average based on composition of blend.

3.4 STORAGE OF BITUMINOUS PAVING MIXTURE

Storage shall conform to the applicable requirements of \-ASTM D 3515-\; however, in no case shall the mixture be stored for more than 4 hours.

3.5 TRANSPORTATION OF BITUMINOUS MIXTURE

Transportation from paving plant to site shall be in trucks having tight, clean, smooth beds lightly coated with an approved releasing agent to prevent adhesion of the mixture to the truck bodies. Excessive releasing agent shall be drained prior to loading. Each load shall be covered with canvas or other approved material of ample size to protect mixture from weather and to prevent loss of heat. Loads that have crusts of cold, unworkable material or that have become wet will be rejected. Hauling over freshly placed material will not be permitted.

3.6 SURFACE PREPARATION OF UNDERLYING COURSE

Prior to placing of the intermediate or wearing course, the underlying course shall be cleaned of all foreign or objectionable matter with power brooms and hand brooms.

3.7 PRIME COATING

Surfaces of previously constructed base course shall be sprayed with a coat of bituminous material conforming to Section \=02558=\ BITUMINOUS TACK AND PRIME COAT.

3.8 TACK COATING

Contact surfaces of previously constructed pavement, curbs, manholes, and other structures shall be sprayed with a thin coat of bituminous material conforming to Section \=02558=\ BITUMINOUS TACK AND PRIME COAT.

3.9 PLACING

Bituminous courses shall be constructed only when the base course or existing pavement has no free water on the surface. Bituminous mixtures shall not be placed without ample time to complete spreading and rolling

during daylight hours, unless approved satisfactory artificial lighting is provided.

3.9.1 Offsetting Joints

The wearing course shall be placed so that longitudinal joints of the wearing course will be offset from joints in the intermediate course by at least 300 mm. Transverse joints in the wearing course shall be offset by at least 600 mm from transverse joints in the intermediate course.

3.9.2 General Requirements for Use of Mechanical Spreader

Range of temperatures of mixtures, when dumped into the mechanical spreader, shall be as determined by the Contracting Officer. Mixtures having temperatures less than 110 degrees C when dumped into the mechanical spreader shall not be used. The mechanical spreader shall be adjusted and the speed regulated so that the surface of the course being laid will be smooth and continuous without tears and pulls, and of such depth that, when compacted, the surface will conform to the cross section indicated. Placing with respect to center line areas with crowned sections or high side of areas with one-way slope shall be as directed. Placing of the mixture shall be as nearly continuous as possible, and speed of placing shall be adjusted, as directed, to permit proper rolling. When segregation occurs in the mixture during placing, the spreading operation shall be suspended until the cause is determined and corrected.

3.9.3 Placing Strips Succeeding Initial Strips

In placing each succeeding strip after initial strip has been spread and compacted as specified below, the screed of the mechanical spreader shall overlap the previously placed strip 50 to 75 mm and be sufficiently high so that compaction produces a smooth dense joint. Mixture placed on the edge of a previously placed strip by the mechanical spreader shall be pushed back to the edge of the strip by use of a lute. Excess mixture shall be removed and wasted.

3.9.4 Handspreading in Lieu of Machine Spreading

In areas where the use of machine spreading is impractical, the mixture shall be spread by hand. Spreading shall be in a manner to prevent segregation. The mixture shall be spread uniformly with hot rakes in a loose layer of thickness that, when compacted, will conform to required grade, density, and thickness.

3.10 COMPACTION OF MIXTURE

Rolling shall begin as soon after placing as the mixture will bear a roller without undue displacement. Delays in rolling freshly spread mixture will not be permitted. After initial rolling, preliminary tests of crown, grade, and smoothness shall be made by the Contractor. Deficiencies shall be corrected so that the finished course will conform to requirements for grade and smoothness specified herein. Crown, grade, and smoothness will be checked in each lot of completed pavement by the Contractor for compliance. After the Contractor is assured of meeting crown, grade, and smoothness requirements, rolling shall be continued until a mat density of 97.0 to 100.0 percent and a joint density of 95.0 to 100.0 percent of density of

laboratory-compacted specimens of the same mixture is obtained. Places inaccessible to rollers shall be thoroughly compacted with hot hand tampers.

3.10.1 Testing of Mixture

At the start of the plant operation, a quantity of mixture shall be prepared that is sufficient to construct a test section at least 15 m long, two spreader widths wide and of thickness to be used in the project. Mixture shall be placed, spread, and rolled with equipment to be used in the project and in accordance with the requirements specified above. This test section shall be tested and evaluated as a lot and shall conform to all specified requirements. If test results are satisfactory, the test section shall remain in place as part of the completed pavement. If tests indicate that the pavement does not conform to specification requirements, necessary adjustments to plant operations and rolling procedures shall be made immediately. Additional test sections, as directed, shall be constructed and sampled for conformance to specification requirements. In no case shall the Contractor start full production of an intermediate or wearing course mixture without approval.

3.10.2 Correcting Deficient Areas

Mixtures that become contaminated or are defective shall be removed to the full thickness of the course. Edges of the area to be removed shall be cut so that sides are perpendicular and parallel to the direction of traffic and so that the edges are vertical. Edges shall be sprayed with bituminous materials conforming to Section \=02558=\ BITUMINOUS TACK AND PRIME COAT. Fresh paving mixture shall be placed in the excavated areas in sufficient quantity so that the finished surface will conform to grade and smoothness requirements. Paving mixture shall be compacted to the density specified herein. Skin patching of an area that has been rolled shall not be permitted.

3.11 JOINTS

3.11.1 General

Joints between old and new pavements, between successive work days, or joints that have become cold (less than 80 degrees C) shall be sawed back to a vertical face to insure continuous bond between the old and new sections of the course. All joints shall have the same texture and smoothness as other sections of the course. Contact surfaces of previously constructed pavements coated by dust, sand, or other objectionable material shall be cleaned by brushing or shall be cut back as directed. When directed by the Contracting Officer, the surface against which new material is placed shall be sprayed with a thin, uniform coat of bituminous material conforming to Section \=02558=\ BITUMINOUS TACK AND PRIME COAT. Material shall be applied far enough in advance of placement of a fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

3.11.2 Transverse Joints

The roller shall pass over the unprotected end of a strip of freshly placed material only when placing is discontinued or delivery of the mixture is interrupted to the extent that the material in place may become cold. In all cases, prior to continuing placement, the edge of previously placed

pavement shall be cut back to expose an even vertical surface for full thickness of the course. In continuing placement of a strip, the mechanical spreader shall be positioned on the transverse joint so that sufficient hot mixture will be spread to obtain a joint after rolling that conforms to the required density and smoothness specified herein.

3.11.3 Longitudinal Joints

Edges of a previously placed strip shall be prepared such that the pavement in and immediately adjacent to the joint between this strip and the succeeding strip meets the requirements for grade, smoothness, and density.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 02920

TOPSOILING

PART 1 - GENERAL

1.1 REFERENCES (Not Applicable)

1.2 SUBMITTALS

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

SD-07 Schedules\

Construction Equipment List\; *FIO*\.

The Contractor shall furnish a list and description of the equipment that is proposed for handling and placing all topsoil.

SD-13 Certificates

Topsoil\; *FIO*\.

The Contractor shall furnish a certificate of compliance and analysis certifying that the topsoil proposed for use at the project site conforms to the specified requirements.

1.3 INSPECTION

Not less than 5 days prior to the commencement of topsoiling operations, the Contracting Officer shall be notified of the offsite sources from which topsoil is to be furnished. The material will be inspected to determine whether the selected topsoil meets the requirements. The topsoil shall be approved prior to use.

PART 2 - PRODUCTS

2.1 TOPSOIL

All topsoil necessary to complete the work shall be obtained from topsoil stockpiles from grading and excavating operations and from approved topsoil sources off of Government controlled property. Topsoil from approved sources and stockpiled topsoil shall be natural, friable, topsoil characteristic of representative soils in the vicinity that produce heavy growths of crops, grass, or other vegetation. Topsoil shall be free from tree roots, stones, shale, parent and other materials that hinder grading, planting, plant growth and maintenance operations, and free from noxious and other objectionable weed seeds and toxic substances.

PART 3 - EXECUTION

3.1 GENERAL

Graded areas shall be topsoiled. Equipment necessary for handling and placing all materials required shall be on hand, in good condition and shall be approved before the work is started. Grades on the areas to be topsoiled are shown on the drawings and shall be maintained in a true and even condition.

3.2 TILLAGE

Immediately prior to dumping and spreading the topsoil, the subgrade shall be double tilled to a depth of 50 mm using a chisel plow with the chisels set not more than 250 mm apart. Tillage shall be accomplished across the slope.

3.3 OBTAINING TOPSOIL

After inspection and approval of the source of topsoil, and prior to stripping, rank growths of vegetation, stones, or debris on the surface that might interfere with grading or later tillage operations shall be removed. Sod or other cover that cannot be disked or otherwise incorporated into the topsoil so that the topsoil can be spread properly shall be removed. Topsoil shall be removed to the depth 100 millimeters.

3.4 PLACING TOPSOIL

Topsoil shall be uniformly distributed and evenly spread to an average thickness of 100 mm , with a minimum thickness of 76 mm . Topsoil shall be spread so that planting can proceed with little additional soil preparation or tillage. Surface irregularities resulting from topsoiling or other operations shall be leveled to prevent depressions. The grades shall be adjusted to assure that the planted grade shall be 25 mm below the adjoining grade of any surfaced area. Topsoil shall not be placed when the subgrade is frozen, excessively wet or compacted, extremely dry, or in a condition detrimental to the proposed planting or grading.

3.5 CLEANUP

| [AM#2] Prior to topsoiling, vegetation that may interfere with operations shall be mowed, grubbed, and raked. The collected material shall be removed from the site. The surface shall be cleaned of stumps, and stones
| larger than ~~100~~25 mm in diameter, and roots, cable, wire and other materials that might hinder the work or subsequent maintenance shall also be removed.

3.6 REPAIR

Where any portion of the surfaces becomes gullied or otherwise damaged, the affected area shall be repaired to establish the condition and grade prior to topsoiling, and then shall be re-topsoiled as specified in paragraph "PLACING TOPSOIL."

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 02960

PLANTING OF TREES, SHRUBS, 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 NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI Z60.1-\ (1996) Nursery Stock

AMERICAN JOINT COMMITTEE ON HORTICULTURAL NOMENCLATURE (AJCHN)

\-AJCHN-01-\ (1942, 2nd Ed.) Standard Plant Names

ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTS (AOAC)

\-AOAC-01-\ Official Methods of Analysis

COMMERCIAL ITEM DESCRIPTIONS (CID)

\-CID A-A-1909-\ (Basic; Notice 1) 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 \=01300=\ SUBMITTAL PROCEDURES:

SD-09 Reports\

Peat Mulch\; *FIO*\.

Certified copies of the analysis of each type of peat mulch used in the project, made by an approved, independent, recognized laboratory in accordance with the current method of the \-AOAC-01-\. Testing shall be at the Contractor's expense. Testing shall be submitted for approval of the Contracting Officer before delivery of the peat.

SD-13 Certificates\

The certificates listed below shall be submitted for approval prior to commencement of work:

Fertilizer\; *FIO*\.

One certificate for each type to be used in the project.

Soil Amendments\; *FIO*\.

Certificates for each type of soil amendment.

Peat Mulch\; *FIO*\.

Certificates for each type of peat mulch shall be submitted to the Contracting Officer showing type, percent of organic matter, origin, and the amount to be utilized on the project.

Woodbark Mulch\; *FIO*\.

Certificates shall list all information on the container label and the amounts of each type to be used on the project.

SD-18 Records\

Plant Material\; *FIO*\.

All necessary inspection certificates shall accompany the invoice for each shipment or order of stock, as may be required by law for the necessary transportation, and such certificates shall be filed with the Contracting Officer prior to acceptance of the materials.

1.3 INSPECTION

1.3.1 Plant Materials

All shipments or orders of plant material shall be properly inspected at the nursery or at the site by the Authorized Federal and State authorities.

1.3.2 Topsoil

Off base sources of topsoil shall be inspected to determine the acceptability of the topsoil, including the maximum depth to which it is to be stripped.

1.4 DIGGING UP, WRAPPING, HANDLING AND DELIVERY

Plants shall be dug and prepared for shipment in a manner that will not cause any damage to the branches, shape, root system, and future development of the plants after replanting. Plants shall not be handled by the trunk or stems. Damaged plants will be rejected and shall be removed from the site.

1.4.1 Balled and Burlapped Plants

Balled and burlapped plants, designated BB in the list of required plants, shall be adequately balled with firm natural balls of soil in sizes as shown on the drawings. Balls shall be firmly wrapped with burlap or substitute approved cloth. No balled plant shall be planted if the ball is cracked, mushy, or broken, or if the stem is loose in the ball, either before or during the process of planting. Balled plants shall be lifted and handled from the bottom of the ball.

1.4.2 Container-Grown Plants

Container-grown plants, designated "can" in the list of required plants, shall have been grown in cans. Plants shall have sufficient roots to hold earth together intact after removal from containers without being rootbound.

1.4.3 Options as to Methods

If all other requirements are met, any plant other than trees (unless otherwise indicated on the drawings) may be furnished container-grown instead of balled and burlapped. Any substitutions shall be made only with approval of the Contracting Officer at no change in the contract price.

1.4.4 Shipment and Delivery

The Contractor shall promptly notify the Contracting Officer, in advance, when the plant material will be delivered and the manner of shipment. The Contractor shall furnish an itemized list, in duplicate, of the actual quantity of plant material in each delivery, in order to insure satisfactory coordination of delivery and to expedite the required inspection at the point of delivery. The itemized list of the plant material for each delivery shall include the pertinent data as specified in the list of required plants. This list and the necessary inspection certificates to accompany each plant or shipment shall be delivered to the Contracting Officer, prior to acceptance and planting of the plant material.

1.4.4.1 Protection During Delivery

Plants shall be protected during delivery to prevent damage to the root balls or desiccation of leaves. Trees shall be protected during transportation by tying in the branches and covering all exposed branches. When shipment is made by truck, all plant material shall be packed to provide adequate protection against climatic, seasonal, and breakage injuries during transit. The tops shall be securely covered with tarpaulin or canvas to minimize wind-whipping and drying. When shipment is made by rail, box cars shall be carefully packed and adequately ventilated to prevent sweating of the plants during transit. Shipments made by rail to local or nearby freight yards shall be given special attention to insure prompt delivery and careful handling therefrom to the point of final delivery at the planting jobsite. Under no circumstances shall balled plants be dropped from box cars or trucks to the ground. A suitable method of handling shall be employed to preclude cracked or mushroomed plant balls at the point of delivery.

1.4.4.2 Inspection Upon Arrival

Plant material shall be inspected upon arrival at the jobsite. Unacceptable plant material shall be removed from the jobsite.

1.4.4.3 Commercial Fertilizer

Commercial fertilizer shall be delivered to the site in unopened original containers, each fully labeled, conforming to the applicable State fertilizer laws and bearing the trade name or trademark and warranty of

the producer. Each sack shall bear the manufacturer's statement of analysis, indicating the percentages of available nitrogen, available phosphoric acid, and potash.

1.4.4.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis and name. In lieu of containers, soil amendments may be furnished in bulk and a certificate from the manufacturer indicating the above information shall accompany each delivery.

1.4.4.5 Mulch

Peat shall be delivered to the jobsite in unopened bags or in unbroken bales. Woodbark shall be delivered to the site in unopened containers and shall be fully labeled.

1.4.5 Protection Against Freezing and Drying Out

1.4.5.1 Plant Storage

Care shall be taken to avoid drying or damaging plants being moved from the nursery or storage area to the planting site. All plants shall be handled so that roots are adequately protected at all times from drying out and from other injury. Balled and burlapped plants shall be handled carefully to avoid cracking or breaking the earth ball. The balls of balled plants that cannot be planted immediately on delivery shall be well protected with soil or other acceptable material. The Contractor shall safeguard the unplanted plants during freezing weather by inside storage and other precautionary measures. Bare root plants shall be heeled out with roots completely covered with wet soil or other approved material immediately upon delivery.

1.4.5.2 Storage of Other Materials

Soil amendments shall be kept in dry storage away from contaminants. Storage of materials shall be in areas designated or as approved by the Contracting Officer.

1.5 WARRANTY

Furnished plant material shall have a warranty for plant growth to a vigorous growing condition for a minimum 12 month period, regardless of the contract time. When plant material is determined to be unhealthy in accordance with paragraph REPLACEMENT, it shall be replaced as necessary under this warranty.

PART 2 - PRODUCTS

2.1 PLANTS REQUIRED

The species (scientific and common names), size, and manner in which to be furnished, are given in the plant list shown on the drawings.

2.1.1 Substitutions

Plants of kinds other than those named in plant list will not be accepted unless specifically approved in writing by the Contracting Officer. Proposed substitutes, in each case, must possess the same essential characteristics as the kind of plant actually specified in regard to appearance, ultimate height, shape, habit of growth, general soil and other requirements. In no case shall the average cost and value of substituted plants be less than the cost and value of plants actually specified. Plants of greater value may be accepted without additional cost to the Government.

2.2 PLANT MATERIALS

All plant material furnished shall be nursery-grown, well branched, full-foliaged, and well proportioned, particularly with respect to the width-height relationship, and shall have a fibrous root system. The Government may inspect plants at place of growth, but such inspection shall not preclude the right of rejection at the site.

2.2.1 Nomenclature

The scientific and common names of plants herein specified or shown on the drawings conform with the approved names given in \-AJCHN-01-\, Standard Plant Names, except that where local usage does not follow this standard, the accepted local names are given in parentheses.

2.2.2 Plant Material Labels

For the purpose of inspection and plant identification, durable, legible labels stating in weather-resistant ink the correct plant name and size, as specified in the list of required plants, shall be securely attached to all plants, bundles, and containers of plant material delivered at the planting site.

2.2.3 Quality and Size

Quality and size of plants shall be in accordance with rules and grading adopted by the American Association of Nurserymen, Inc., and included in \-ANSI Z60.1-\. All plants shall be of excellent quality and have a normal habit of growth and shall be sound, healthy, vigorous, and free from disease and insect infestations, and damage. Trees shall have single straight trunks unless otherwise specified. Any tree with weak thin trunk not capable of supporting itself when planted in the open will not be accepted. The minimum acceptable sizes of all plants, measured before pruning, with branches in normal position, shall conform to the measurements specified hereinafter in the list of required plants. Plants larger in size than specified may be used with the approval of the Contracting Officer, but the use of larger plants will make no change in contract price. If the use of larger plants is approved, the ball of earth or spread of roots shall be increased proportionately.

2.3 BURLAP

Burlap shall be made of jute and shall weigh not less than 255 ml per square meter. Substitute cloth shall possess an equal strength and resistance to tearing.

2.4 COMMERCIAL FERTILIZER

Fertilizer shall be commercial grade, free flowing, uniform in composition and conforming to \-CID A-A-1909-\.

2.4.1 Dry Fertilizer

a. Granular fertilizer

Consists of nitrogen-phosphorous-potassium ratio: 10percent nitrogen, 10 percent phosphorous, and 10 percent potassium.

b. Controlled-Release Fertilizer

Consists of nitrogen-phosphorous-potassium ratio: 10 percent nitrogen, 10 percent phosphorous, and 10 percent potassium. Controlled-release fertilizer may be in packet or tablet form.

2.4.2 Liquid Fertilizer

Commercially available liquid fertilizer shall consist of completely soluble plant foods suitable for application as foliage spray.

2.5 SOIL AMENDMENTS

2.5.1 Sulphur

Sulphur shall be finely ground, raw, agricultural grade, with a purity of at least 98 percent.

2.5.2 Iron Sulphate

Iron sulphate shall be the fine salt form of the chemical $FeSO_4$, free of lumps, suitable for uniform mixing with soil.

2.5.3 Root Stimulator

Slow release root stimulator.

2.5.4 Preemergent

Granular preemergent.

2.6 MATERIAL FOR STAKING

2.6.1 Stakes and Braces

Stakes for supporting trees shall be square, straight, sound, rough sawn, free from knots, and not less than nominal 50 mm by 50 mm square. Stakes and braces shall be painted green using approved wood stain or paint.

2.6.2 Wire

Wires for tying trees to stakes shall be annealed galvanized steel or steel of gages hereinafter specified.

2.7 MULCH

Mulch shall consist of materials as specified below:

a. Peat

Peat shall be natural product of sphagnum moss or sedge peat, taken from a fresh-water site. Peat shall be free of lumps, roots, and stones or other foreign matter, and of such physical condition that the peat can be passed through a 13 mm mesh screen and can be readily incorporated with the topsoil. Peat shall have been conditioned in storage piles after excavation for at least 6 months, including one freezing and thawing period or processed with a dehydrator. Peat shall contain not less than 70 percent organic matter by weight on an ovendry basis.

b. Woodbark

At the Contractor's option, woodbark may be used as mulch. Woodbark shall be a natural product of pine bark. The bark shall be manufactured for the use of plant mulch and shall be free from weed, seed, soil, plant diseases and insects.

2.8 TOPSOIL

| [AM#2] Topsoil shall be obtained from approved off-post sources. The topsoil source shall be inspected by the Contracting Officer to determine if the selected soils meet the following requirements. The topsoil shall be stripped from the top 100 mm to 150 mm surface layer of soil. Topsoil shall be fertile, friable, natural surface soil, free of subsoil, clods, shale, trash, toxic substances, stones ~~50~~25 mm in maximum dimension or larger, Bermudagrass, Johnsongrass, nutgrass (Cyperus rotundus), or other objectionable and hard to eradicate weeds or grasses.

2.9 WATER

Water shall be kept free from oil, acids, alkali, salt, and other substances harmful to the growth of plants. The source of water and service outlets used shall be subject to approval of the Contracting Officer.

PART 3 - EXECUTION

3.1 PLANTING SEASON

The planting season for trees, shrubs, and vines shall be from 1 January to 15 March; planting shall be accomplished during the first planting season, or portion thereof (but not less than 15 days), following substantial completion of building construction. Actual planting shall be performed during the specified periods only when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved by the Contracting Officer. Deviation from the planting dates will be permitted only when approved in writing by the Contracting Officer.

3.2 OBSTRUCTIONS BELOW GROUND

Any rock or other underground obstruction shall be removed to the depth necessary to permit proper planting, according to plans and specifications. If underground construction, obstructions, or rock are encountered in excavation of planting areas, other locations for the planting may be selected by the Contracting Officer. Explosives may be

used for removal of rock or oil foundation structures only where and as expressly approved by the Contracting Officer. The Contractor shall familiarize himself with all existing underground utility locations and shall avoid damaging them during planting operations. The Contractor shall repair at his own expense any damage to existing utilities and such repairs shall be in a manner directed by the Contracting Officer.

3.3 PLANTING OPERATIONS

3.3.1 Layout of Major Planting

Locations for plants and outlines of areas to be planted shall be marked on the ground by the Contractor and approved by the Contracting Officer before any excavation is made. No shrubs shall be planted less than 1 meter from a building unless specifically indicated on the drawings or designated by the Contracting Officer. In the event obstructions are encountered which prevent planting as indicated, the plant or plants will be planted in a new location, as directed by the Contracting Officer.

3.3.2 Protection of Planting Areas

Before excavations are made, precautionary measures shall be taken to protect all turfed areas that are to be trucked over and upon which soil is to be temporarily stacked pending removal or reuse of the soil for the filling of holes, pits, and beds. Existing trees, shrubbery, and beds that are to be preserved shall be barricaded in a manner to afford effective protection during planting operations.

3.3.3 Excavation for Planting

Excavation for planting shall include the stripping and stacking of all acceptable topsoil encountered within the areas to be excavated for trenches, plant pits, and planting beds. Most of the excavated material will not be acceptable for backfill. Except as otherwise indicated, excavations of trenches, tree holes and plant pits shall extend to the required subgrades as indicated on the drawings but in no case shall be less than as specified. Plant pits shall be circular in outline and shall have vertical sides and flat bottoms, or may be machine dug in a square shape with vertical sides and flat bottoms provided the minimum width of square pits is as great as the diameter for the circular pits. The minimum depths of plant pits shown on the drawings shall be measured from finished grade. Planting beds in which ground cover or similar planting are indicated shall be excavated to the depth shown on the drawings and as required to eliminate Bermudagrass, Johnsongrass, nutgrass (Cyperus rotundus) or similar objectionable vegetation which would seriously compete with the plantings. In the event such vegetation is present, the surface soil shall be stripped to a depth of 150 mm to 305 mm , as required to eliminate underground rootstalks or rhizomes.

3.3.4 Preparation of Planting Beds (PB)

3.3.4.1 Preparation (For Use Without Planters)

The planting beds for ground cover, outlines of which are shown on the drawings, shall be excavated to a depth of 380 mm . The acceptable topsoil which is free of noxious plants shall be stockpiled and used as backfilled material. Unacceptable excavated soil shall be disposed of as

directed by the Contracting Officer. During excavation operations all roots, stones, grade stakes or other objects 50 mm in maximum dimension or larger shall be removed from beds and disposed of as directed by the Contracting Officer. Plants to be planted in plant beds are indicated by PB in the legend on the drawings.

3.3.4.2 Backfilling

The plant beds shall be backfilled with topsoil specified herein. Wet peat shall then be spread uniformly over the bed to a depth of 150 mm , and shall be mixed and incorporated into the soil to a depth of 230 mm using a roto-tiller or similar type of equipment to obtain a uniform and well pulverized soil mix. During tillage operations, all roots, stones, stakes, or other objectionable objects shall be removed from the beds and disposed of as directed. Beds shall be brought to a smooth even surface conforming to established grades and the details shown on the drawings after full settlement has occurred. The mixed soil in the beds shall be moist at the time the plants are set.

3.3.5 Planting Pit Sizes

Minimum depth and diameter or width of planting pits for trees, shrubs, and vines shall be as shown in the plant list on the drawings. Plants to be placed outside of planting beds shall be planted in pits with depths and diameters as shown on drawings for each plant.

3.3.6 Disposal of Excess Soil

Acceptable excess excavated topsoil shall be wasted uniformly over nearby low or rough lawn areas, or otherwise disposed of as approved by the Contracting Officer. Excess soils not required or not suitable for above usage shall be disposed of on or off the reservation as directed by the Contracting Officer, within 24 hours following excavation.

3.3.7 Setting Plants

Except as otherwise specified, plants shall be planted in pits and shall be set at the level shown in the details on the drawings. Trees shall be set plumb and rigidly braced in position until the soil has been tamped solidly around the ball or roots. Plants shall be planted in approved topsoil, as specified herein, which shall be thoroughly settled by watering and tamping. To compensate for shrinkage, the finished grade of topsoil prior to watering shall be fixed at an elevation 10 percent of the fill depth higher than the desired finished grade, unless otherwise directed by the Contracting Officer. To facilitate watering, each plant shall be set approximately 50 mm below the grade of the existing ground surface to form a saucer as shown on the drawings.

3.3.7.1 Balled Plants

Balled-and-burlapped (BB) plants shall be placed on a minimum of 150 mm of compacted topsoil, as shown on the drawings, that has been hand tamped prior to placing plants. Plants shall then be placed in the plant pit, and the topsoil shall be tamped to fill all voids under the base and around the ball to a height of one-half the depth of the ball. Cloth, ropes, wires, and other wrapping material shall be cut away from the top

of the balls, and backfilling shall be completed. In no case shall cloth be pulled out from under balls.

3.3.7.2 Container-Grown Plants

Containers shall be opened, and the plants carefully removed so that the earth around the roots of the plants remains unbroken. Plants shall then be planted in the same manner as balled plants.

3.3.8 Staking of Trees

3.3.8.1 Balled and Burlapped Trees

Balled and burlapped trees shall be staked as they are planted with three stakes, as specified under materials, and as shown on the drawings. Trees shall be held firmly between the stakes with a double strand of guying material. Chafing guards shall be used with guying material and shall not girdle tree. Flags shall be securely fastened to each guy line between the tree and stake and shall be visible to pedestrians.

3.3.9 Pruning

Pruning shall be limited to the minimum necessary to remove injured twigs and branches, and to compensate for the loss of roots during transplanting, but never to exceed one-half of the branching structure. With the approval of the Contracting Officer, pruning may be done before delivery of plants, but not before plants have been inspected and approved. All cuts shall be made flush leaving no stubs. Cuts over 19 mm in diameter shall be painted with an approved tree-wound paint. To further aid in the recovery of transplanted trees, the leaves may be stripped prior to shipment where this is a locally accepted practice and approved by the Contracting Officer. Evergreens shall not be pruned except to remove injured branches.

3.3.10 Mulching

After planting and application of fertilizer, plants shall be mulched with a layer of wet mulch material covering the entire saucer area around each plant to a depth of 50 mm.

3.4 MAINTENANCE OPERATIONS

Maintenance operations shall begin immediately after each plant is planted and shall continue for a period of not less than 365 calendar days after the last plant of the original planting is planted, mulched, and staked, where applicable and until all landscaping and turfing work under this contract is completed and accepted. Plants shall be kept in a healthy growing condition by watering, pruning, spraying, weeding, cultivating, and by any other necessary operations of maintenance. Plant saucers and planting beds shall be kept free of weeds, grass, and other undesired vegetative growth. Plants shall be inspected at least weekly by the Contractor during the maintenance period and necessary work shall be promptly performed. The plant material shall be watered as necessary to prevent desiccation and maintin an adequate supply of moisture within the root zone. An adequate supply of moisture is the equivalent of 50 mm absorbed water per week. Run-off, puddling, and wilting shall be prevented. Immediately after all plants have been planted and staked,

fertilizer and soil amendments specified hereinbefore shall be centrally mixed in a manner approved by the Contracting Officer, using the following proportions:

9 parts of fertilizer.

3 parts of soil sulphur.

1 part of iron sulfate.

In the course of mixing operations, any lumps larger than 13 mm in diameter shall be broken up and when uniformly mixed the material shall be uniformly distributed over the surface of planting pits and beds in the manner described below at the following areas:

Trees 44 mm to 50 mm caliber	0.45 kg
Trees less than 44 mm in caliber	0.34 kg
Shrubs	0.23 kg
Plant beds per 10 sq. meter	1.00 kg

Fertilizer application shall be accomplished as follows: Fertilizer and soil amendments shall be applied at the specified rates over the planting beds and pits. Fertilizer shall not be applied closer than 150 mm to trunks of trees and stems of shrubs. Any fertilizer on the foliage of plants shall be washed off immediately following application. Following the application of fertilizer and soil amendments, the peat shall be applied as specified over the saucers, and beds and incorporated by forking with the top 50 mm of soil. The pits and beds, shall then be watered with sufficient water to wet the entire root structure of the plants.

3.5 REPLACEMENT

During the planting period, plants that die or are, in the opinion of the Contracting Officer, in an unhealthy, unsightly, or impaired condition, shall be replaced by the Contractor prior to the commencement of the maintenance period. Three days prior to the conclusion of the maintenance period, the Contracting Officer and the Contractor will make an inspection of the work to determine condition of all plants. All plants that are dead or not in a healthy growing condition, as determined by the Contracting Officer, will be noted. All plants noted to be unhealthy, unsightly, or damaged, shall be removed from the site and replaced with healthy plants of the same kinds and sizes as originally specified during the period 1 January to 15 March. Such replacements shall be made in the same manner as specified for the original planting, except all trees shall be balled-and-burlapped, and at no extra cost to the Government. Maintenance of the replacements will be by the Government after the original maintenance period.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

\-ACI 318/318R-\	(1995) Building Code Requirements for Structural Concrete and Commentary

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 82-\	(1995a) Steel Wire, Plain, for Concrete Reinforcement
\-ASTM A 184-\	(1990) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
\-ASTM A 185-\	(1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
\-ASTM A 497-\	(1995) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
\-ASTM A 615-\	(1995b) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

\-CRSI MSP-1-\	(1990) Manual of Standard Practice

1.2 SUBMITTALS

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

SD-04 Drawings\

Concrete Reinforcement System\; *GA*\.

Detail drawings showing reinforcing steel placement, schedules, sizes, grades, and splicing and bending details. Drawings shall show support details including types, sizes and spacing.

SD-13 Certificates\

Reinforcing Steel\; *FIO*\.

Certified copies of mill reports attesting that the reinforcing steel furnished meets the requirements specified, prior to the installation of reinforcing steel.

1.3 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 PRODUCTS

2.1 FABRICATED BAR MATS

Fabricated bar mats shall conform to \-ASTM A 184-\.

2.2 *REINFORCING STEEL*\

Reinforcing steel shall be deformed bars conforming to \-ASTM A 615-\ or \-ASTM A 706-\, grades and sizes as indicated.

2.3 WELDED WIRE FABRIC

| [AM#2] Welded wire fabric shall conform to \-ASTM A 185-\ or \-ASTM A 497-\.
| Rolled wire fabric is not allowed; only sheets of welded wire fabric is
| permitted.

2.4 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

2.5 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with \-CRSI MSP-1-\ and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 100 by 100 mm 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 13 mm of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish 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.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of \-ACI 318/318R-\. 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. Wire tie ends shall face away from the forms.

3.1.1 Placement

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 318/318R-\ 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 318/318R-\. 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.

3.1.2 Splicing

Splices of reinforcement shall conform to \-ACI 318/318R-\ and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. 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 150 mm. 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 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. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 50 mm. 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 1.22 m. Fabric shall be positioned by the use of supports. Only panel welded wire is acceptable. No rolled welded wire will be used for slab work.

3.3 DOWELS

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

PART
1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

\-AASHTO M 182-\	(1991I) Burlap Cloth Made From Jute or Kenaf

ACI INTERNATIONAL (ACI)

\-ACI 117/A117R-\	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
\-ACI 211.1-\	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
\-ACI 214.3R-\	(1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
\-ACI 301-\	(1996) Specifications for Structural Concrete for Buildings
\-ACI 303R-\	(1991) Guide to Cast-In-Place Architectural Concrete Practice
\-ACI 305R-\	(1991) Hot Weather Concreting
\-ACI 318/318R-\	(1995) Building Code Requirements for Reinforced Concrete and Commentaries

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 31-\	(1991) Making and Curing Concrete Test Specimens in the Field
\-ASTM C 33-\	(1993) Concrete Aggregates
\-ASTM C 39-\	(1994) Compressive Strength of Cylindrical Concrete Specimens
\-ASTM C 42-\	(1994) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

\-ASTM C 94-\	(1995) Ready-Mixed Concrete
\-ASTM C 131-\	(1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
\-ASTM C 136-\	(1995a) Sieve Analysis of Fine and Coarse Aggregates
\-ASTM C 143-\	(1990a) Slump of Hydraulic Cement Concrete
\-ASTM C 150-\	(1995) Portland Cement
\-ASTM C 171-\	(1995) Sheet Materials for Curing Concrete
\-ASTM C 172-\	(1990) Sampling Freshly Mixed Concrete
\-ASTM C 173-\	(1994a) Air Content of Freshly Mixed Concrete by the Volumetric Method
\-ASTM C 192-\	(1990a) Making and Curing Concrete Test Specimens in the Laboratory
\-ASTM C 231-\	(1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
\-ASTM C 260-\	(1995) Air-Entraining Admixtures for Concrete
\-ASTM C 309-\	(1995) Liquid Membrane-Forming Compounds for Curing Concrete
\-ASTM C 494-\	(1992) Chemical Admixtures for Concrete
\-ASTM C 496-\	(1990) Splitting Tensile Strength of Cylindrical Concrete Specimens
\-ASTM C 595-\	(1994a) Blended Hydraulic Cements
\-ASTM C 618-\	(1995) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
\-ASTM C 685-\	(1995) Concrete Made by Volumetric Batching and Continuous Mixing
\-ASTM C 881-\	(1990) Epoxy-Resin-Base Bonding Systems for Concrete
\-ASTM C 937-\	(1980, R 1991) Grout Fluidifier for Preplaced-Aggregate Concrete
\-ASTM C 940-\	(1989) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
\-ASTM C 989-\	(1994a) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

\-ASTM C 1017-\	(1992) Chemical Admixtures for Use in Producing Flowing Concrete
\-ASTM C 1059-\	(1991) Latex Agents for Bonding Fresh to Hardened Concrete
\-ASTM C 1064-\	(1986, R 1993) Temperature of Freshly Mixed Portland Cement Concrete
\-ASTM C 1077-\	(1995b) Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
\-ASTM C 1107-\	(1991a) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
\-ASTM C 1240-\	(1995) Silica Fume for Use in Hydraulic Cement Concrete and Mortar
\-ASTM D 75-\	(1987; R 1992) Sampling Aggregates
\-ASTM D 1751-\	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
\-ASTM D 1752-\	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
\-ASTM E 96-\	(1995) Water Vapor Transmission of Materials
\-ASTM E 1155-\	(1987) Determining Floor Flatness and Levelness Using the F-Number System

CORPS OF ENGINEERS (COE)

\-COE CRD-C 94-\	(1995) Surface Retarders
\-COE CRD-C 104-\	(1980) Method of Calculation of the Fineness Modulus of Aggregate
\-COE CRD-C 400-\	(1963) Requirements for Water for Use in Mixing or Curing Concrete
\-COE CRD-C 521-\	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete
\-COE CRD-C 540-\	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

\-NIST HB 44-\	(1995) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

\-NRMCA TMMB-01-\	(1992) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards of the Truck Mixer Manufacturers Bureau
\-NRMCA CPMB 100-\	(1990) Concrete Plant Standards
\-NRMCA QC 3-\	(1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

| 1.2 [AM#2] DELETED _____.

| 1.2.1 [AM#2] DELETED _____.

| 1.2.2 [AM#2] DELETED _____.

1.3 SUBMITTALS

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

SD-08 Statements\

Mixture Proportions\; *GA*\.

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

SD-09 Reports\

Testing and Inspection for Contractor Quality Control\; *GA*\.

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

SD-13 Certificates\

Qualifications\; *FIO*\.

Written documentation for Contractor Quality Control personnel. All personnel performing sampling and testing of concrete shall be ACI - Grade I certified in the field testing of concrete as required in paragraph QUALIFICATIONS.

SD-14 Samples\

Surface Retarder\; *FIO*\.

Surface retarder material with manufacturer's instructions for application in conjunction with air-water cutting.

1.4 *QUALIFICATIONS*\

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I
Concrete Laboratory Testing Technician, Grade I or II
Concrete Construction Inspector, Level II

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

| 1.5 [AM#2] FIELD TEST ~~PANELS~~GRADE BEAMS

| [AM#2] Field test ~~panels~~grade beams shall be constructed prior to beginning of work using the materials and procedures proposed for use on the job, to demonstrate the results to be attained. The quality and appearance of each | ~~panel~~grade beam shall be subject to the approval of the Contracting | Officer, and, if not judged satisfactory, additional ~~panels~~grade beams shall be constructed until approval is attained. Formed or finished surfaces in the completed structure shall match the quality and appearance | of the approved field example. The field test grade beam shall be "L" | shaped with legs 4' x 8' and height per typical grade beam on the plans.

1.6 SPECIAL REQUIREMENTS

A pre-installation meeting with the Contracting Officer will be required at least 10 days prior to start of construction. The Contractor shall be responsible for calling the meeting; the Project Superintendent and active installation personnel shall be present.

1.7 GENERAL REQUIREMENTS

1.7.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with \-ACI 117/A117R-\. Level and grade tolerance measurements of slabs shall be made as soon as possible

after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

1.7.1.1 Floors

For the purpose of this Section the following terminology correlation between \-ACI 117/A117R-\ and this Section shall apply:

Floor Profile Quality Classification From \-ACI 117/A117R-\	This Section
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish
Very Flat	

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

1.7.1.2 Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of \-ACI 117/A117R-\, using a 3 m straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straightedge can be placed.

Bullfloated	12.7
Straightedged	12.7
Float Finish	6.4
Trowel Finish	6.4

1.7.2 Strength Requirements and w/c Ratio

1.7.2.1 Strength Requirements

Specified compressive strength (f'c) shall be as follows:

COMPRESSIVE STRENGTH	STRUCTURE OR PORTION OF STRUCTURE
27.5 MPa at 28 days	Foundation walls, exterior exposed.
20 MPa at 28 days	All other unless noted otherwise.

a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (152 by 305 mm cylinders) shall be fabricated by an approved testing laboratory and laboratory cured in accordance with \-ASTM C 31-\ and tested in accordance with \-ASTM C 39-\. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 3.5 MPa. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when

the strength of the concrete in the structure is considered potentially deficient.

b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 3.5 MPa or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with \-ASTM C 42-\. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.

c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of \-ACI 318/318R-\. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

1.7.3 Air Entrainment

All normal weight concrete shall be air entrained to contain between 3 and 5 percent total air. Concrete with specified strength over 35 MPa may have 1.0 percent less air than specified above. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with \-ASTM C 231.

1.7.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with \-ASTM C 143-\.

Structural Element	Slump Minimum	Slump Maximum
Foundation Walls, footings, pier caps, drilled piers and beams	50 mm	100 mm
Footings, slabs	25 mm	75 mm
Any structural concrete approved for placement by pumping:	100 mm	150 mm

When use of a plasticizing admixture conforming to \-ASTM C 1017-\ or when a Type F or G high range water reducing admixture conforming to \-ASTM C 494-\ is permitted to increase the slump of concrete, concrete shall have a slump of 50 to 100 mm before the admixture is added and a maximum slump of 200 mm at the point of delivery after the admixture is added. If a super plastizer is used, it shall be added at the job site by the plasticizer manufacturer's representative.

1.7.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 32 degrees C. When the ambient temperature during placing is 5 degrees C or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 12 and 25 degrees C.

1.7.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

1.7.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

1.7.8 Technical Service for Concrete

All technicians performing sampling and testing of concrete shall be ACI - Grade I certified in the field testing of concrete.

1.8 *MIXTURE PROPORTIONS*\

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

1.8.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of

the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with \-ASTM C 192-\ and tested in accordance with \-ASTM C 39-\. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in \-ACI 211.1-\, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in \-ACI 211.1-\. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations in \-ACI 211.1-\ for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with \-ASTM C 192-\. They shall be tested at 7 and 28 days in accordance with \-ASTM C 39-\. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

1.8.2 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength (f'cr) exceeding the specified compressive strength (f'c) by the amount indicated below. This required average compressive strength, f'cr, will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below f'cr during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day f'cr, the mixture shall be adjusted, as approved, to bring the daily average back up to f'cr. During production, the required f'cr shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

1.8.2.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of \-ACI 214.3R-\. Test records from which a standard deviation is calculated shall represent

materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths (f'c) within 7 MPa of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'cr used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

$$f'cr = f'c + 1.34S$$

$$f'cr = f'c + 2.33S - 500$$

Where S = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

1.8.2.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength f'cr shall be determined as follows:

a. If the specified compressive strength f'c is less than 20 MPa,

$$f'cr = f'c + 6.9 \text{ MPa}$$

b. If the specified compressive strength f'c is 20 to 35 MPa,

$$f'cr = f'c + 8.3 \text{ MPa}$$

1.9 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

1.10 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

1.10.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with \-ASTM D 75-\. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

1.10.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with \-ASTM C 172-\ and tested in accordance with these specifications, as considered necessary.

1.10.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

1.10.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, or portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

2.1.1 Portland Cement

\-ASTM C 150-\, Type I low alkali with a maximum 15 percent amount of tricalcium aluminate. The alkai content shall not exceed 0.6 precast.

2.1.2 Pozzolan (Fly Ash)

\-ASTM C 618-\, Class C or F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of \-ASTM C 618-\. Requirement for maximum alkalies from Table 1A of \-ASTM C 618-\ shall apply. If pozzolan is

used, it shall never be less than 15 percent nor more than 20 percent by weight of the total cementitious material.

2.2 AGGREGATES

"Coarse and fine aggregate shall be washed." Aggregates shall conform to the following.

2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of \-ASTM C 33-\.

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to \-ASTM C 33-\, Class 5S.

Maximum sizes as follows:
a. 12.7 mm: Topping slab.
b. 38.1 mm: Beams, foundation walls.
c. 50.8 mm: Footings, piers and mass concrete.

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing. Calcium chloride or admixtures containing more than 0.05% calcium ions by weight of admixture are not permitted.

2.3.1 Air-Entraining Admixture

\-ASTM C 260-\ and shall consistently entrain the air content in the specified ranges under field conditions.

2.3.2 Accelerating Admixture

\-ASTM C 494-\, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

2.3.3 Water-Reducing or Retarding Admixture

| [AM#2] \-ASTM C 494-\, Type A, B, or D, except that the 6-month and 1-year
| compressive and flexural strength tests are waived. Water reducers and retarders
| shall be added to the concrete mix at the job site under the control of the Q.C..

2.3.4 High-Range Water Reducer

| [AM#2] \-ASTM C 494-\, Type F or G, except that the 6-month and 1-year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of
| separate mixture design studies. Water reducers and retarders shall be added to
| the concrete mix at the job site under the control of the Q.C..

2.3.5 *Surface Retarder*\

\-COE CRD-C 94-\.

2.3.6 Expanding Admixture

Aluminum powder type expanding admixture conforming to \-ASTM C 937-\.

2.3.7 Other Chemical Admixtures

Chemical admixtures for use in producing flowing concrete shall comply with \-ASTM C 1017-\, Type I or II. These admixtures shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.4 CURING MATERIALS

2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to \-ASTM C 171-\, type optional, except, that polyethylene sheet shall not be used.

2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to \-ASTM C 309-\, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in \-ASTM C 309-\ waived.

2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to \-AASHTO M 182-\.

2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of \-COE CRD-C 400-\.

2.6 NONSHRINK GROUT

Nonshrink grout shall conform to \-ASTM C 1107-\, Grade A, and shall be a commercial formulation suitable for the proposed application.

2.7 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to \-ASTM C 1059-\.

2.8 EPOXY RESIN

Epoxy resins for use in repairs shall conform to \-ASTM C 881-\, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

2.9 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel.

2.10 FLOOR HARDENER

Apply floor hardener in mechanical and electrical rooms or as otherwise indicated. Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These silicofluorides can be used individually or in combination. Proprietary hardeners may be used if approved in writing by the Contracting Officer.

2.11 JOINT MATERIALS

2.11.1 Joint Fillers, Sealers, and Waterstops

Expansion joint fillers shall be preformed materials conforming to \-ASTM D 1751-\ \-ASTM D 1752-\. Materials for and sealing of joints shall conform to the requirements of Section \=07920=\ JOINT SEALING \=02592=\ FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS \=02593=\ COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS.

2.11.2 Contraction Joints in Slabs

Sawable type contraction joint inserts shall conform to \-COE CRD-C 540-\. Nonsawable joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of \-COE CRD-C 540-\, with the exception of Section 3.4 "Resistance to Sawing". Plastic inserts shall be polyvinyl chloride conforming to the materials requirements of \-COE CRD-C 572-\.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section \=03100=\ STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section \=03200=\ CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1 Foundations

3.1.1.1 Concrete on Fiber Void Forms

Fiber void surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.1.2 Excavated Surfaces in Lieu of Forms

Concrete for footings and walls may not be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section \=02221=\ EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

3.1.2 Previously Placed Concrete

Concrete surfaces to which additional concrete is to be bonded shall be prepared for receiving the next horizontal lift by cleaning the construction joint surface with either air-water cutting, sandblasting, high-pressure water jet, or other approved method. Concrete at the side of vertical construction joints shall be prepared as approved by the Contracting Officer. Air-water cutting shall not be used on formed surfaces or surfaces congested with reinforcing steel. Regardless of the method used, the resulting surfaces shall be free from all laitance and inferior concrete so that clean surfaces of well bonded coarse aggregate are exposed and make up at least 10-percent of the surface area, distributed uniformly throughout the surface. The edges of the coarse aggregate shall not be undercut. The surface of horizontal construction joints shall be kept continuously wet for the first 12 hours during the 24-hour period prior to placing fresh concrete. The surface shall be washed completely clean as the last operation prior to placing the next lift.

3.1.2.1 Air-Water Cutting

Air-water cutting of a fresh concrete surface shall be performed at the proper time and only on horizontal construction joints. The air pressure used in the jet shall be 700 kPa plus or minus, 70 kPa, and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. When approved by the Contracting Officer, a surface retarder complying with the requirements of \-COE CRD-C 94-\ may be applied to the surface of the lift in order to prolong the period of time during which air-water cutting is effective. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, high-pressure waterjet or sandblasting shall be used as the last operation before placing the next lift.

3.1.2.2 High-Pressure Water Jet

A stream of water under a pressure of not less than 20 MPa shall be used for cutting and cleaning. Its use shall be delayed until the concrete is sufficiently hard so that only the surface skin or mortar is removed and there is no undercutting of coarse-aggregate particles. If the waterjet is incapable of a satisfactory cleaning, the surface shall be cleaned by sandblasting.

3.1.2.3 Wet Sandblasting

Wet sandblasting shall be used after the concrete has reached sufficient strength to prevent undercutting of the coarse aggregate particles. After wet sandblasting, the surface of the concrete shall then be washed thoroughly to remove all loose materials.

3.1.2.4 Waste Disposal

The method used in disposing of waste water employed in cutting, washing, and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor, or affect exposed surfaces of the structures, or damage the environment of the project area. The method of disposal shall be subject to approval.

3.1.2.5 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be thoroughly washed and shall be moist but without free water when concrete is placed.

3.1.3 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 600 mm of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

3.2 CONCRETE PRODUCTION

3.2.1 Batching, Mixing, and Transporting Concrete

Concrete shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with \-ASTM C 94-\, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with \-NRMCA TMMB-01-\. Ready-mix plant equipment and facilities shall be certified in accordance with \-NRMCA QC 3-\. Approved batch tickets shall be furnished for each load of ready-mixed concrete.

3.2.1.1 General

The batching plant shall be located off site close to the project. The batching, mixing and placing system shall have a capacity of at least 50 cubic meters per hour. The batching plant shall conform to the requirements of \-NRMCA CPMB 100-\ and as specified; however, rating plates attached to batch plant equipment are not required.

3.2.1.2 Batching Equipment

The batching controls shall be semiautomatic or automatic, as defined in \-NRMCA CPMB 100-\. A semiautomatic batching system shall be provided with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. The batching system shall be equipped with

accurate recorder or recorders that meet the requirements of \-NRMCA CPMB 100-\. The weight of water and admixtures shall be recorded if batched by weight. Separate bins or compartments shall be provided for each size group of aggregate and type of cementitious material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. If both portland cement and other cementitious material are used, they may be batched cumulatively, provided that the portland cement is batched first. Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Admixtures shall be furnished as a liquid of suitable concentration for easy control of dispensing. An adjustable, accurate, mechanical device for measuring and dispensing each admixture shall be provided. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation. The plant shall be arranged so as to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

3.2.1.3 Scales

The weighing equipment shall conform to the applicable requirements of CPMB Concrete Plant Standard, and of \-NIST HB 44-\, except that the accuracy shall be plus or minus 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices. The tests shall be made at the specified frequency in the presence of a Government inspector. The weighing equipment shall be arranged so that the plant operator can conveniently observe all dials or indicators.

3.2.1.4 Batching Tolerances

(A) Tolerances with Weighing Equipment

MATERIAL	PERCENT OF REQUIRED WEIGHT
Cementitious materials	0 to plus 2
Aggregate	plus or minus 2
Water	plus or minus 1
Chemical admixture	0 to plus 6

(B) Tolerances with Volumetric Equipment

For volumetric batching equipment used for water and admixtures, the following tolerances shall apply to the required volume of material being batched:

MATERIAL	PERCENT OF REQUIRED MATERIAL
Water:	plus or minus 1 percent
Chemical admixtures:	0 to plus 6 percent

3.2.1.5 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched.

3.2.1.6 Concrete Mixers

Mixers shall be stationary mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

3.2.1.7 Stationary Mixers

Concrete plant mixers shall be drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or shall be pug mill type and shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixing time and uniformity shall conform to all the requirements in \-ASTM C 94-\ applicable to central-mixed concrete.

3.3 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in agitators, or by approved pumping equipment.

3.4 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

3.4.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 0.2 square meters. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 1.5 cubic meters shall not be manually operated. The design of the bucket shall provide means for

positive regulation of the amount and rate of deposit of concrete in each dumping position.

3.4.2 Transfer Hoppers

Concrete may be charged into nonagitating hoppers for transfer to other conveying devices. Transfer hoppers shall be capable of receiving concrete directly from delivery vehicles and shall have conical-shaped discharge features. The transfer hopper shall be equipped with a hydraulically operated gate and with a means of external vibration to effect complete discharge. Concrete shall not be held in nonagitating transfer hoppers more than 30 minutes.

3.4.3 Trucks

Truck agitators used for transporting plant-mixed concrete shall conform to the requirements of \-ASTM C 94-\. Nonagitating equipment shall be used only for transporting plant-mixed concrete over a smooth road and when the hauling time is less than 15 minutes. Bodies of nonagitating equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

3.4.4 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

3.4.5 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 100 mm. Aluminum pipe shall not be used.

3.5 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 30 degrees C, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

3.5.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 1.5 meters 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 300 mm thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

3.5.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 100 mm thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.6 mm, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 150 mm into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 100 mm and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segration or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with \-COE CRD-C 521-\. Grate tampers ("jitterbugs") shall not be used.

3.5.3 Cold Weather Requirements

Special protection measures, approved by the Contracting Officer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 5 degrees C. The temperature of the concrete when placed shall be not less than 10 degrees C nor more than 25 degrees C. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to

\-ASTM C 494-\, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

3.5.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 30 degrees C, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with \-ASTM C 1064-\. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 49 degrees C. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	33 C
40-60	30 C
Less than 40	27 C

Concrete shall be placed in accordance with \-ACI 305R-\. During periods of warm weather, the following precautions shall be taken to prevent the formation of plastic-shrinkage cracks resulting from excessive loss of moisture from the concrete:

a. The metal forms and/or underlying base or subgrade materials that will not be covered by vapor barrier or similar material shall be cooled by sprinkling or fogging with water immediately before the placement of concrete.

b. All concrete shall be delivered to the forms at a temperature below 29 degrees C, except that concrete with retarding admixtures may have temperatures of 29 degrees to 32 degrees C as deposited in the forms.

c. Placement may be allowed only at night or in early morning hours if necessary to maintain the concrete temperature and keep forms cool.

d. The concrete shall be placed and finished as rapidly as practicable and curing will start immediately after final finishing has been completed on any section of a floor or placement.

e. The finished surface of the concrete shall be kept damp by applying a water fog or mist with approved spraying equipment until mats can be applied as required by the moist curing method.

f. Curing for the first 24 hours after placement shall be by the moist curing method. After this initial curing period any of the specified methods may be used for the remaining period of curing."

3.5.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of \-ACI 305R-\. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

3.5.6 Placing Concrete in Congested Areas

Special care shall be used to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, waterstops and other tight spacing. An appropriate concrete mixture shall be used, and the nominal maximum size of aggregate (NMSA) shall meet the specified criteria when evaluated for the congested area. Vibrators with heads of a size appropriate for the clearances available shall be used, and the consolidation operation shall be closely supervised to ensure complete and thorough consolidation at all points. Where necessary, splices of reinforcing bars shall be alternated to reduce congestion. Where two mats of closely spaced reinforcing are required, the bars in each mat shall be placed in matching alignment to reduce congestion. Reinforcing bars may be temporarily crowded to one side during concrete placement provided they are returned to exact required location before concrete placement and consolidation are completed.

3.5.7 Placing Flowable Concrete

If a plasticizing admixture conforming to \-ASTM C 1017-\ is used or if a Type F or G high range water reducing admixture is permitted to increase the slump, the concrete shall meet all requirements of paragraph GENERAL REQUIREMENTS in PART 1. Extreme care shall be used in conveying and placing the concrete to avoid segregation. Consolidation and finishing shall meet all requirements of paragraphs Placing Concrete, Finishing Formed Surfaces, and Finishing Unformed Surfaces. No relaxation of requirements to accommodate flowable concrete will be permitted.

3.6 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls shall be at the underside of slabs, beams, or girders and at the tops of footings unless otherwise approved. Joints shall be perpendicular to the main reinforcement.

All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 50 mm clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 1.5 kg per square meter asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section \=07920=\ JOINT SEALING.

3.6.1 Construction Joints

Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 25 mm square-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 25 mm above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

3.6.2 Contraction Joints in Topping Slabs

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by use of rigid inserts impressed in the concrete during placing operations or sawing a continuous slot with a concrete saw. Regardless of method used to produce the weakened plane, it shall be 1/4 the depth of the slab thickness and between 3 and 5 mm wide. For saw-cut joints, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent ravelling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Reservoir for joint sealant shall be formed as previously specified.

3.6.3 Expansion Joints

Installation of expansion joints and sealing of these joints shall conform to the requirements of Section \=03250=\ EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS and Section \=07920=\ JOINT SEALING.

3.6.4 Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section \=03200=\ CONCRETE REINFORCEMENT and herein. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

3.7 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section \=03100=\ STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of \-ACI 117/A117R-\. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

3.7.1 Class C and Class D Finish

Class C finish is required in the following areas: concealed surfaces not exposed to view, and all surfaces not covered by Class D finish. Class D finish is required in the following areas: crawl space, and walls and foundation surfaces against which backfill will be placed. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section \=03100=\ STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 12 mm deep or more than 50 mm in diameter shall be repaired. Defects more than 50 mm in diameter shall be cut back to sound concrete, but in all cases at least 25 mm deep.

3.8 REPAIRS

3.8.1 Repair of Major Defects

Major defects will be considered to be those more than 12 mm deep or, for Class C and D finishes, more than 50 mm in diameter. Also included are any defects of any kind whose depth is over 100 mm or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

3.8.1.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 50 mm on all sides. All such defective areas greater than 7800 square mm shall be outlined by saw cuts at least 25 mm deep. Defective areas less than 7800 square mm shall be outlined by a 25 mm deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

3.8.1.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 150 mm deep and also have an average diameter at the surface more than 450 mm or that are otherwise so identified by the Project Office. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced.

3.8.2 Resinous and Latex Material Repair

In lieu of the portland cement bonding coats specified above, an epoxy resin or a latex bonding agent may be used.

3.9 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

3.9.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 10 degrees C. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.9.2 Rough Slab Finish

As a first finishing operation for unformed surfaces, the surface shall receive a rough slab finish prepared as follows. The concrete shall be uniformly placed across the slab area, consolidated as previously specified, and then screeded with straightedge strikeoffs immediately after consolidation to bring the surface to the required finish level with no coarse aggregate visible. Side forms and screed rails shall be provided, rigidly supported, and set to exact line and grade. Allowable tolerances for finished surfaces apply only to the hardened concrete, not to forms or screed rails. Forms and screed rails shall be set true to line and grade. "Wet screeds" shall not be used.

3.9.3 Floated Finish

Slabs to receive more than a rough slab finish shall next be given a wood float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 6 mm and the water sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

3.9.4 Troweled Finish

After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the

machine manufacturer. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

3.9.5 Non-Slip Finish

Non-slip floors shall be constructed in accordance with the following subparagraphs.

3.9.5.1 Broomed

Areas as indicated on the drawings shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a hair coarse fiber push-type broom across the surface. Brooming shall be transverse to traffic or at right angles to the slope of the slab. After the end of the curing period, the surface shall be vigorously broomed with a coarse fiber broom to remove all loose or semi-detached particles.

3.10 FLOOR HARDENER

The following areas electrical and mechanical rooms shall be treated with floor hardener. Floor hardener shall be applied after the concrete has been cured and then air dried for 14 days. Three coats shall be applied, each the day after the preceding coat was applied. For the first application, 0.5 kg of the silocofluoride shall be dissolved in 4 liters of water. For subsequent applications, the solution shall be 1.0 kg of silicofluoride to each 4 liters of water. Floor should be mopped with clear water shortly after the preceding application has dried to remove encrusted salts. Proprietary hardeners shall be applied in accordance with the manufacturer's instructions. During application, area should be well ventilated. Precautions shall be taken when applying silicofluorides due to the toxicity of the salts. Any compound that contacts glass or aluminum should be immediately removed with clear water.

3.11 EXTERIOR SLAB AND RELATED ITEMS

3.11.1 Pavements

Pavements shall be constructed where shown on the drawings. After forms are set and underlying material prepared as specified, the concrete shall be placed uniformly throughout the area and thoroughly vibrated. As soon as placed and vibrated, the concrete shall be struck off and screeded to the crown and cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the required elevation. The entire surface shall be tamped with the strike off, or consolidated with a vibrating screed, and this operation continued until the required compaction and reduction of internal and surface voids are accomplished. Care shall be taken to prevent bringing excess paste to the surface. Immediately following the final consolidation of the surface, the pavement shall be floated longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, additional concrete shall be placed and screeded, and the float operated until a satisfactory surface has been produced. The floating operation

shall be advanced not more than half the length of the float and then continued over the new and previously floated surfaces. After finishing is completed but while the concrete is still plastic, minor irregularities and score marks in the pavement surface shall be eliminated by means of long-handled cutting straightedges. Straightedges shall be 3.75 m in length and shall be operated from the sides of the pavement and from bridges. A straightedge operated from the side of the pavement shall be equipped with a handle 1 m longer than one-half the width of the pavement. The surface shall then be tested for trueness with a 3.75 straightedge held in successive positions parallel and at right angles to the center line of the pavement, and the whole area covered as necessary to detect variations. The straightedge shall be advanced along the pavement in successive stages of not more than one-half the length of the straightedge. Depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. The straightedge testing and finishing shall continue until the entire surface of the concrete is true. Before the surface sheen has disappeared and well before the concrete becomes nonplastic, the surface of the pavement shall be given a nonslip sandy surface texture by belting with approved "belt" and procedures use of a burlap drag. A strip of clean, wet burlap from 1.0 to 1.5 m wide and 0.7 m longer than the pavement width shall be carefully pulled across the surface. Edges and joints shall be rounded with an edger having a radius of 3 mm. Curing shall be as specified.

3.11.2 Sidewalks

Concrete shall be 100 mm minimum thickness. Contraction joints shall be provided at 1.75 m spaces unless otherwise indicated. Contraction joints shall be cut 25 mm deep with a jointing tool after the surface has been finished. Transverse expansion joints 12 mm thick shall be provided at changes in direction and where sidewalk abuts curbs, steps, rigid pavement, or other similar structures. Sidewalks shall be given a lightly broomed finish. A transverse slope of 1 mm per 50 mm shall be provided, unless otherwise indicated. Variations in cross section shall be limited to 1 mm per 250 mm.

3.11.3 Curbs and Gutters

Concrete shall be formed, placed, and finished by hand using a properly shaped "mule" or constructed using a slipform machine specially designed for this work. Contraction joints shall be cut 75 mm deep with a jointing tool after the surface has been finished. Expansion joints (12 mm wide) shall be provided at 35 m maximum spacing unless otherwise indicated. Exposed surfaces shall be finished using a stiff bristled brush.

3.11.4 Pits and Trenches

Pits and trenches shall be constructed as indicated on the drawings. Bottoms and walls shall be placed monolithically or waterstops and keys, shall be provided as approved.

3.12 CURING AND PROTECTION

3.12.1 General

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 10 degrees C for the first 3 days and at a temperature above 0 degrees C for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded. Concrete containing silica fume shall be initially cured by fog misting during finishing, followed immediately by continuous moist curing. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

3.12.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

3.12.3 Membrane Forming Curing Compounds

Concrete may be cured with a nonpigmented curing compound containing a fugitive dye in lieu of moist curing. Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete, including surfaces to which a smooth finish is to be applied or other concrete to be bonded. However, a styrene acrylate or chlorinated rubber compound meeting \-ASTM C 309-\, Class B requirements, may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be

thoroughly moistened with water. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 500 kPa, at a uniform coverage of not more than 10 cubic meters per L for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. Surfaces on which clear compound is used shall be shaded from direct rays of the sun for the first 3 days. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

3.12.4 Impervious Sheeting

Except for plastic coated burlap, impervious sheeting alone shall not be used for curing. Impervious-sheet curing shall only be used on horizontal or nearly horizontal surfaces. Surfaces shall be thoroughly wetted and be completely covered with the sheeting. Sheeting shall be at least 450 mm wider than the concrete surface to be covered. Covering shall be laid with light-colored side up. Covering shall be lapped not less than 300 mm and securely weighted down or shall be lapped not less than 100 mm and taped to form a continuous cover with completely closed joints. The sheet shall be weighted to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Coverings shall be folded down over exposed edges of slabs and secured by approved means. Sheets shall be immediately repaired or replaced if tears or holes appear during the curing period.

3.12.5 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 10 degrees C less than the temperature of the concrete.

3.12.6 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 0 degrees C the temperature of the concrete shall be maintained above 5 degrees C for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 13 degrees C as determined by suitable temperature measuring devices furnished by the Government, as required, and installed adjacent to the concrete surface and 50 mm inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed.

3.13 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 20 mm. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed. Nonshrink grout shall be used for all applications.

3.13.1 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.

3.13.2 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

3.13.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces receiving the grout, shall be maintained at 18 to 30 degrees C until after setting.

3.14 *TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL*\

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with \-ASTM C 1077-\. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per month thereafter for conformance with \-ASTM C 1077-\.

3.14.1 Grading and Corrective Action

3.14.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with \-ASTM C 136-\ and \-COE CRD-C 104-\ for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most

advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

3.14.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with \-ASTM C 136-\ for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

3.14.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by \-ASTM C 33-\. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

3.14.3 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

3.14.4 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining

agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic meter, amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic meter for each class of concrete batched during each day's plant operation.

3.14.5 Concrete Mixture

a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with \-ASTM C 231-\ for normal weight concrete. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.

b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.

c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with \-ASTM C 143-\ for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in

workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 12.5 mm below the maximum allowable slump specified in paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 50 mm. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.

d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.

e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with \-ASTM C 1064-\. The temperature shall be reported along with the compressive strength data.

f. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 380 cubic meters or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. Test specimens shall be molded and cured in accordance with \-ASTM C 31-\ and tested in accordance with \-ASTM C 39-\ for test cylinders. Results of all strength tests shall be reported immediately to the

Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in parargraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in \-ACI 214.3R-\.

3.14.6 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

3.14.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

3.14.8 Vibrators

The frequency and amplitude of each vibrator shall be determined in accordance with \-COE CRD-C 521-\ prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph Consolidation, shall be immediately removed from service and repaired or replaced.

3.14.9 Curing Inspection

a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.

b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.

c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the

quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square meters per Liter, and shall note whether or not coverage is uniform.

d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.

f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

3.14.10 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

3.14.11 Mixer Uniformity

a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 6,000 cubic meters of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be determined in accordance with \-ASTM C 94-\.

c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

3.14.12 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 04255

NONBEARING MASONRY VENEER/STEEL STUD WALL

PART
1 GENERAL

1.1 REFERENCES

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

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

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

AMERICAN IRON AND STEEL INSTITUTE (AISI)

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 36-\	(1994) Carbon Structural Steel
\-ASTM A 82-\	(1995a) Steel Wire, Plain, for Concrete Reinforcement
\-ASTM A 123-\	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
\-ASTM A 153-\	(1996) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
-TM A 653-\	(1995) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
\-ASTM C 79-\	(1994) Gypsum Sheathing Board
\-ASTM C 90-\	(1995) Load-Bearing Concrete Masonry Units
\-ASTM C 91-\	(1995) Masonry Cement
\-ASTM C 216-\	(1995) Facing Brick (Solid Masonry Units Made from Clay or Shale)
\-ASTM C 270-\	(1995a) Mortar for Unit Masonry
\-ASTM C 494-\	(1992) Chemical Admixtures for Concrete

\-ASTM C 665-\	(1994) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
\-ASTM C 780-\	(1994) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
\-ASTM C 954-\	(1993) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
\-ASTM C 955-\	(1995) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases
\-ASTM C 1002-\	(1993) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases
\-ASTM C 1072-\	(1994) Measurement of Masonry Flexural Bond Strength
\-ASTM D 1056-\	(1991) Flexible Cellular Materials - Sponge or Expanded Rubber
\-ASTM D 1330-\	(1985; R 1990) Rubber Sheet Gaskets
\-ASTM D 1667-\	(1976; R 1990) Flexible Cellular Materials - Vinyl Chlorine Polymers and Copolymers (Closed-Cell Foam)

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

-HRAE 81930-\	(1993) Handbook, Fundamentals I-P Edition

AMERICAN WELDING SOCIETY (AWS)

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

CAST STONE INSTITUTE (CSI)

\-CSI 04720-\	(1997) Standard Specification (for cast stone)

DEPARTMENT OF COMMERCE (DOC)

\-DOC PS 1-\	(1983) Construction and Industrial Plywood

1.2 SUBMITTALS

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

SD-01 Data\

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

Tabular data as necessary, demonstrating the structural performance of the cold-formed steel framing system for the specified loadings and deflection criteria in accordance with the provisions of \-AISI SG-671-\. This analysis shall be in accordance with -SC M016-\. Test results demonstrating that the veneer anchors are structurally adequate to resist the specified loadings shall be submitted for approval.

SD-04 Drawings\

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

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

SD-14 Samples\

Expansion Joint Materials\; *FIO*\.

Brick\; *GA*\.

Concrete Masonry Units\; *GA*\.

Sample Panel\; *FIO*\.

A portable panel, approximately 600 by 600 mm, containing approximately 24 brick facings and 24 of each type concrete masonry units to establish the range of color and texture. One of each type of masonry veneer anchor used.

SD-13 Certificates\

Brick\; *FIO*\.

Concrete Masonry Units\; *FIO*\.

Joint Reinforcement\; *FIO*\.

Expansion Joint Materials\; *FIO*\.

Veneer Anchors\; *FIO*\.

Welders Qualification\; *FIO*\.

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

1.3 SAMPLE PANEL

After the material samples are approved and prior to starting masonry work, a sample masonry panel shall be built on the project site where directed. The sample panel shall be not less than 1.8 m long by 1.2 m high. The panel shall be of typical wall thickness for the construction represented. The panel shall show color range, texture, bond pattern, expansion joints, and cleaning of the masonry as required in the work. The panel shall also show cold-formed steel framing, insulation, gypsum wallboard, gypsum sheathing, dampproofing, veneer anchors, joint reinforcement, steel shelf angles, flashing and weep holes. The approved sample panel shall be used as a standard of workmanship required in the actual installation. The sample panel shall be protected from weather and construction operations and shall not be removed until the masonry veneer/steel stud wall work has been completed and accepted.

1.4 DELIVERY, HANDLING AND STORAGE

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

1.5 EFFLORESCENCE TESTS

Efflorescence tests shall be performed by an approved commercial testing laboratory. Sampling for the tests shall be the responsibility of the Contractor. Brick shall be sampled and tested for efflorescence in accordance with \-ASTM C 67-\ and the rating shall be: "not effloresced".

PART 2 PRODUCTS

2.1 VENEER WYTHE

2.1.1 Clay or Shale Brick

Clay or shale brick veneer shall be masonry units conforming to \-ASTM C 216-\, Type FBS. Color range and texture shall be as indicated and shall conform to the approved sample. Grade SW shall be used for all brickwork. Brick unit sizes shall be modular.

2.1.2 Concrete Masonry Unit

Concrete masonry unit veneer shall be solid and conform to \-ASTM C 90-\, Type I. Architectural type, color range and texture shall be as indicated and shall conform to the approved sample. Masonry unit sizes shall be

modular. Total linear drying shrinkage shall be less than 0.03% as described in ASTM C 90. Maximum moisture content measured as a percentage of total absorption shall not exceed amounts stated in ASTM C 90 for the applicable climate for the project site.

2.1.2.1 Split Face Units: full size unit; as indicated on drawing.

2.1.2.2 Ground Face Units: 200 x 400 mm face size unit; thickness as indicated on drawings.

2.1.2.3 Water Repellant Admixture: Manufacture all units with exterior exposure with integral water repellant admixture equal to Dry-Block Integral Water-Repellent Admixture for block as manufactured by Grace Construction Products, Div. of W.R. Grace. Producer shall be certified by admixture manufacturer.

2.2 MORTAR

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

2.2.1 Masonry Cement

Masonry cement not permitted.

2.2.2 Admixtures

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

2.2.2.1 Water Repellant Admixture: For construction of walls with exterior exposure mortar shall have integral water repellant admixture equal to Dry-Block Integral Water-Repellent Admixture for mortar as manufactured by Grace Construction Products, Div. of W.R. Grace.

2.3 JOINT REINFORCEMENT

Joint reinforcement shall be of steel wire conforming to \-ASTM A 82-\. Fabrication shall be by welding. Tack welding will not be permitted. Reinforcement shall be zinc-coated after fabrication in accordance with \-ASTM A 153-\, Class B-2. Joint reinforcement shall consist of at least 1 continuous longitudinal wire in the veneer wythe. Minimum wire cross section shall be 11 square mm.

2.4 COLD-FORMED STEEL FRAMING

Cold-formed framing shall consist of steel studs, top and bottom tracks, runners, horizontal bridging, and other cold-formed members and other accessories. All members and components made of sheet steel shall be hot-dip galvanized in accordance with -TM A 653-\ with a minimum coating thickness of G 60. Framing covered herein shall be used only in framing the

exterior masonry veneer steel stud wall system as indicated on the drawings. Metal framing for interior partitions are specified in Section \=09250=\ GYPSUM WALLBOARD.

2.4.1 Steel Studs

Studs shall conform to \-ASTM A 653-\, Grade 33, having a minimum yield strength of 230 MPa . Studs shall be cold-formed from minimum base metal thickness steel as noted on the construction drawings.

2.4.2 Runners, Tracks, Bridging and Accessories

All cold-formed steel sheet framing members, components, and accessories, other than the steel studs, shall conform to \-ASTM C 955-\ and be of steel conforming to -TM A 653-\, Grade 33 , having a minimum yield strength of 230 MPa.

2.5 INSULATION

2.5.1 Blanket Insulation

Insulation placed between the steel studs shall be batt or blanket type fiberglass onforming to \-ASTM C 665-\, Type III Class B or C, thermal value of not less than R-19.

2.5.2 Acoustic Insulation

Acoustic insulation specified in Section \=09250=\ GYPSUM WALLBOARD.

2.6 GYPSUM WALLBOARD

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

2.7 EXTERIOR SHEATHING

Gypsum sheathing that is installed on the exterior side of the cold-formed steel framing system shall have a minimum thickness of 12 mm and shall be 1.2 m wide. Gypsum sheathing shall conform to \-ASTM C 79-\. Gypsum sheathing shall have a water-resistant gypsum core with a water-repellent paper or glass fiber facer firmly bonded to the core.

2.8 ASHPALT SATURATED FELT

2.8.1 Ashpalt Saturated Felt

Asphalt-saturated felt conforming to \-ASTM D 226-\ Type I (No. 30) 5.25 kN/m tensile strength.

2.8.2 Staples

| [AM#2] Staples for attaching the asphalt felt to the exterior sheathing shall be the type and size best suited to provide a secure connection. Staples shall be made from either galvanized steel or stainless steel wire.
| Staples shall be installed at 400 mm on center both ways.

2.8.3 Joint Tape

Tape for sealing the joints in the asphalt felt shall be 50 mm wide; glass-fiber fabric reinforced tape with laminated plastic outer face and pressure sensitive adhesive (duct tape).

2.9 VENEER ANCHORS

Anchor assemblies for the attachment of the masonry veneer to the cold-formed steel framing, structural steel and/or concrete beam and column members, and concrete floor slabs will be as shown. Length of anchor wires shall be such that the outermost wires lie between 32 mm from each face of the masonry veneer. Anchors wires shall not have drips. Wires for veneer anchors shall be rectangular or triangular hoops formed from 5 mm diameter steel wire conforming to \-ASTM A 82-\. Anchor assemblies including wires and anchor plates shall be hot-dip galvanized conforming to \-ASTM A 153-\, Class B-2. The veneer anchor shall have a minimum capacity of 900 newtons. The load-displacement capacity of each veneer anchor, both in direct pull-out for tension and compression, shall not be less than 350 kilo newtons per meter (or a deflection of 2.85 mm per kilo newton of load in tension or compression). In the direction perpendicular to the masonry veneer, the anchor assembly shall have a maximum play of 1.6 mm.

2.9.1 Adjustable Pintle-Eye Type Wire Anchors

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

2.10 CONNECTIONS

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

2.10.1 Framing Screws, Bolts and Anchors

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

2.10.2 Welding

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

2.10.3 Veneer Anchor Screws

Screws for attachment of the veneer anchors to the cold-formed steel framing members shall be as required by design to provide the needed pullout load capacity but not less than No. 12. Screws shall be shown on the detail drawings. The length of screws shall be such that the screws penetrate the holding member by not less than 16 mm.

2.10.4 Gypsum Sheathing Screws

Screws for attachment of gypsum sheathing to cold-formed steel framing shall conform to \-ASTM C 954-\.

2.11 SYNTHETIC RUBBER WASHERS

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

2.12 EXPANSION JOINT MATERIAL

Expansion joint materials shall be bellows or U-shaped type conforming to Section \=07600=\ SHEET METALWORK, GENERAL. Premolded type shall be closed-cell cellular rubber conforming to \-ASTM D 1056-\ or closed-cell vinyl or polyvinyl chloride conforming to \-ASTM D 1667-\.

2.13 FLASHING

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

2.14 STEEL LINTELS AND SHELF ANGLES

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

2.15 CAULKING AND SEALANTS

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

2.16 CAST STONE BUILDING NUMBER

Provide cast stone unit with recessed building numbers as shown. Units shall comply with requirements of \-CSI 04720-\. Color and texture to match natural limestone.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

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

3.2 STEEL STUD WALL FRAMING

| [AM#2] The top track of the stud wall system shall be slip jointed to accommodate vertical deflections of the supporting members as shown on the drawings. Top and bottom tracks shall be anchored by one anchor at each stud location as shown on the drawings. Both flanges of all steel studs shall be securely fastened with screws to the flanges of the top and bottom tracks as shown on the drawings. All details for affixing steel studs to runners and all other sheet steel framing members along with all details necessary for

anchorage of the steel stud wall system to the building structural systems shall be shown on the drawings. Horizontal bridging shall be provided and spaced as necessary. Studs shall be spaced 400 mm on center. Coordinate stud spacing with sheathing and anchor requirements. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door and window openings. Door frames and other built-in items shall be spot grouted at the jamb anchor locations.

3.3 STEEL SHELF ANGLES

Unless otherwise shown, steel shelf angles shall be provided in segments that do not exceed 3.0 m in length. At building corners, shelf angle segments shall be mitered and securely attached together by welding with legs no less than 1.2 m where possible. Elsewhere, shelf angles segments shall not be connected together but instead shall be installed with 6 mm wide gaps between the segments. Fabrication and erection tolerances shall be in accordance with the AISC Code of Standard Practice, as indicated in \-AISC-03-\.

3.4 INSULATION

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

3.5 GYPSUM WALLBOARD

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

3.6 EXTERIOR SHEATHING

Sheathing shall be installed on the exterior face of the cold-formed steel framing system with self-drilling screws. Screws shall be located a minimum of 10 mm from the ends and edges of sheathing panels and shall be spaced not more than 200 mm on each supporting member except at vertical slip joints, the sheathing should be connected to the vertical studs only so as not to prevent movement of the slip joint. Edges and ends of gypsum sheathing panels shall be butted snugly with vertical joints staggered to provide full and even support for the moisture barrier. All holes and gaps resulting from abandoned screw installations, from damage to panels, and

from cutting and fitting of panels at junctures with doors, windows, foundation walls, floor slabs and other similar locations shall be filled with exterior rubber-base caulk.

3.7 MOISTURE PROTECTION

3.7.1 Asphalt Felt

The asphalt-saturated felt moisture barrier shall be installed on the outer face of the exterior sheathing. The moisture barrier shall be installed horizontally and shingled with each sheet lapped not less than 150 mm over the sheet below. Vertical end joints shall be lapped not less than 300 mm and shall be staggered. Attachment of the moisture barrier shall be with staples spaced not greater than 400 mm on center horizontal and vertical. Brick anchors and all other penetrations thru the asphalt felt shall be sealed with sealant.

3.8 VENEER ANCHORS

Veneer anchors shall be attached with screws through the sheathing and rigid insulation to the steel studs or other support members at the locations shown. When rigid insulation is used, the method of connecting the veneer anchor through the insulation shall be approved by the Contracting Officer. Veneer anchors shall be installed with the outermost wires lying between 16 mm from each face of the masonry veneer. Synthetic rubber washers shall be used between the anchor connector plates and the moisture barrier. A clutch torque slip screw gun shall be used on screws attaching veneer anchors to cold-formed steel members. Veneer anchors with corrugated sheet metal or wire mesh members extending across the wall cavity shall not be used. There shall be one veneer anchor for each 0.2 square meters of wall and shall be attached to steel studs and other supports with a maximum spacing of 600 mm on center. For pintle-eye anchors the vertical distance between the pintle section horizontal wires and the eye section horizontal wires shall not exceed 13 mm. Dovetail slots shall be installed as specified in the Section \=03300=\ CAST-IN-PLACE STRUCTURAL CONCRETE.

3.9 FLASHING

Continuous flashing shall be provided at the bottom of the wall cavity just above grade. Flashing shall also be provided above and below openings at lintels and sills, at shelf angles, and at other location as indicated on the drawings. Flashing shall be as detailed and as specified in Section \=07600=\ SHEET METALWORK, GENERAL. Flashing shall be lapped a minimum of 150 mm at joints and shall be sealed with a mastic as recommended by the flashing manufacturer. Ends over doors, windows and openings shall be turned up and secured. Flashing shall be lapped under the moisture barrier a minimum of 150 mm and securely attached to the gypsum sheathing. Flashing shall extend through the exterior face of the masonry veneer and turned down to form a drip.

3.10 MASONRY VENEER

Exterior masonry wythes shall be constructed to the thickness indicated on the drawings. A cavity consisting of a minimum width air space as indicated on the drawings shall be provided between the moisture barrier and the masonry veneer. Masonry veneer shall not be installed until the exterior sheathing, moisture barrier, veneer anchors and flashing have been installed

on the cold-formed steel framing system. Extreme care shall be taken to avoid damage to the moisture barrier and flashing during construction of the masonry veneer. Any portion of the moisture barrier and flashing that is damaged shall be repaired or replaced prior to completion of the veneer. Masonry shall be placed in running bond pattern. Longitudinal reinforcement consisting of at least one continuous galvanized steel wire shall be placed in the veneer wythe. The minimum wire size shall be 9 gage. Vertical joints on alternating courses shall be aligned and kept vertically plumb. Solid masonry units shall be laid in a non-furrowed full bed of mortar, beveled and sloped toward the center of the wythe on which the mortar is placed. Units shall be shoved into place so that the vertical mortar joints are completely full and tight. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned and relaid. Mortar which protrudes more than 13 mm into the cavity space shall be removed. Means shall be provided to ensure that the cavity space is kept clean of mortar droppings and other loose debris. Chases and raked-out joints shall be kept free from mortar and debris. Faces of units used in finished exposed areas shall be free from chipped edges, material texture or color defects or other imperfections distracting from the appearance of the finished work.

3.10.1 Surface Preparation

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

3.10.2 Hot Weather Construction

Temperatures of masonry units and mortar shall not be greater than 50 degrees C when laid. Masonry erected when the ambient air temperature is more than 37 degrees C in the shade and when the relative humidity is less than 50 percent shall be given protection from the direct exposure to wind and sun for 48 hours after the installation.

3.10.3 Cold Weather Construction

Temperatures of masonry units and mortar shall not be less than 4 degrees C when laid. When the ambient air temperature is 0 degrees C or less, masonry veneer under construction shall be protected and maintained at a temperature greater than 0 degrees C for a period of 48 hours after installation. The proposed method of maintaining the temperature within the specified range shall be submitted for approval prior to implementation. No units shall be laid on a surface having a film of frost or water.

3.10.4 Tolerances

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

TABLE

Variation From Plumb	
In adjacent units	3 mm
In 3 m	6 mm
In 6 m	10 mm
In 12 m or more	13 mm

Variation From Level Or Grades

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

Variation From Linear Building Lines

In 6 m	13 mm
In 12 m or more	19 mm

Variation From Cross Sectional Dimensions Of Walls

Plus	13 mm
Minus	6 mm

3.10.5 Mixing of Mortar

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Measurement of sand shall be accomplished by the use of a container of known capacity or shovel count based on a container of known capacity. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of the masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2 hours shall be discarded.

3.10.6 Cutting and Fitting

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

3.10.7 Masonry Units

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

3.10.8 Mortar Joints

Mortar joint widths shall be uniform and such that the specified widths are maintained throughout. Joints shall be of thickness equal to the difference between the actual and nominal dimensions of the masonry units in either height or length but in no case shall the joints be less than 6 mm nor more than 13 mm wide. Joints shall be tooled slightly concave. Tooling shall be accomplished when mortar is thumbprint hard and in a manner that will compress and seal the mortar joint and produce joints of straight and true lines free of tool marks.

3.10.9 Joint Reinforcement

Unless otherwise shown, joint reinforcement shall be spaced at 400 mm on center vertically. Joint reinforcement shall not be placed in the same masonry course as veneer anchors unless the anchors are designed to accommodate the wire. Joint reinforcement shall be placed so that longitudinal wires are centered in the veneer wythe for solid units. Longitudinal wires shall be fully embedded in mortar for their entire length. Splices in joint reinforcement shall be lapped a minimum of 150 mm. Joint reinforcement must be discontinuous at all veneer joints. The minimum cover for joint reinforcement is 16 mm.

3.10.10 Veneer Joints

Brick expansion joints and concrete masonry veneer control joints shall be provided at the locations shown on the drawings. Details of joints shall be as indicated on the drawings. Joints shall be clean and free of mortar and shall contain only backer rod and sealant, installed in accordance with Section \=07920=\ JOINT SEALING. Horizontal reinforcement shall not extend through the joints.

3.10.11 Weep Holes

Weep holes shall be provided at all flashing locations at intervals of 600 mm. Weep holes shall be placed in head joints just above the flashing. Weep holes shall be formed by extruded plastic weep vents. Weep holes shall be kept free of mortar and other obstructions.

3.10.12 Head Joint Vents

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

3.10.13 Discontinuous Work

When necessary to temporarily discontinue the work, masonry shall be stepped back for joining when work resumes. Toothing may be used only when specifically approved. Before resuming work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned. Top of walls subjected to rain or snow shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimum of 600 mm down on each side of the wall and be held securely in place.

3.10.14 Cleaning

Mortar daubs or splashings shall be completely removed from finished exposed masonry surfaces before they harden or set up. Before completion of the work, all defects in mortar joints shall be raked out as necessary, filled

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

3.10.15 Field Tests

| [AM#2] Field test mortar specimens for compressive strength in accordance
| with \-ASTM C 270-\ at a frequency of one test minimum per ~~week~~day. Each test shall be a minimum of three (3) mortar cubes as per \-ASTM C 109-\. Sand for mortar shall be tested for aggregate gradations as per \-ASTM C
| 144-\ a minimum of one (1) per week. Compressive strengths for mortar
| specimens shall be a minimum compressive strength of 1800 psi.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

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 LRFD, Vol I-\	(1993) Load & Resistance Factor Design Manual, Vol 1 - Structural Members, Specifications and Codes
\-AISC LRFD, Vol II-\	(1993) Load & Resistance Factor Design Manual, Vol II - Connections
\-AISC S303-\	(1992) Code of Standard Practice for Steel Buildings and Bridges
\-AISC S342L-\	(1993) Load and Resistance Factor Design Specification for Structural Steel Buildings
\-AISC S334L-\	(1988) Load and Resistance Factor Design Specification for Structural Joints Using ASTM A325 or A490 Bolts

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 6-\	(1995a) General Requirements for Rolled Structural Bars, Plates, Shapes, and Sheet Piling
\-ASTM A 36-\	(1994) Carbon Structural Steel
\-ASTM A 53-\	(1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
\-ASTM A 307-\	(1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
\-ASTM A 325-\	(1994) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
\-ASTM A 500-\	(1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
\-ASTM A 563-\	(1994) Carbon and Alloy Steel Nuts

\-ASTM A 572-\	(1994b) High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality
\-ASTM F 436-\	(1993) Hardened Steel Washers
\-ASTM F 844-\	(1990) Washers, Steel, Plain (Flat), Unhardened for General Use

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

\-ASME B18.21.1-\	(1994) Lock Washers (Inch Series)
\-ASME B46.1-\	(1985) Surface Texture (Surface Roughness, Waviness and Lay)

AMERICAN WELDING SOCIETY (AWS)

\-AWS A2.4-\	(1993) Standard Symbols for Welding, Brazing and Nondestructive Examination
\-AWS D1.1-\	(1994) Structural Welding Code - Steel

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

\-SSPC Paint 25-\	(1991) 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. Connections, for any part of the structure not shown on the contract drawings, shall be considered simple shear connections and shall be designed and detailed in accordance with pertinent provisions of \-AISC LRFD, Vol I-\ and \-AISC LRFD, Vol II-\. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Officer. \-AISC-04-\ \-AISC S342L-\ with pertinent provisions of \-AISC LRFD, Vol I-\ and \-AISC LRFD, Vol II-\ shall govern the work. Welding shall be in accordance with \-AWS D1.1-\. High-strength bolting shall be in accordance with \-AISC S329-\ \-AISC S334L-\.

1.3 SUBMITTALS

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

SD-04 Drawings\

Structural Steel System\; *GA*\.

Structural Connections\; *GA*\.

Shop and erection details including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with \-AWS A2.4-\.

SD-08 Statements\

Erection\; *GA*\.

Erection plan of the structural steel framing required. Erection plan shall conform to the requirements of \-AISC S303-\, shall be submitted prior to erection, and shall describe all necessary temporary supports, including the sequence of installation and removal.

SD-13 Certificates\

Mill Test Reports\; *FIO*\.

Certified copies of mill test reports for structural steel, structural bolts, nuts, washers and other related structural steel items.

Welder Qualifications\; *FIO*\.

Certified copies of welder qualifications test records showing qualification in accordance with \-AWS D1.1-\.

Fabrication\; *FIO*\.

A copy of the AISC certificate indicating that the fabrication plant meets the specified structural steelwork category.

SD-14 Samples\

High Strength Bolts and Nuts\; *FIO*\.

Carbon Steel Bolts and Nuts\; *FIO*\.

Nuts Dimensional Style\; *FIO*\.

Washers\; *FIO*\.

Random samples of bolts, nuts, and washers as delivered to the job site if requested, 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-\.

2.1.2 High-Strength Low-Alloy Steel

High-strength low-alloy steel shall conform to \-ASTM A 572-\, Grade 344 mPa.

2.2 STRUCTURAL TUBING

Structural tubing shall conform to \-ASTM A 500-\, Grade 318 mPa.

2.3 STEEL PIPE

Steel pipe shall conform to \-ASTM A 53-\, Type E, Grade B.

2.4 *HIGH STRENGTH BOLTS AND NUTS*\

High strength bolts shall conform to \-ASTM A 325-\, Type 1 with carbon steel nuts conforming to \-ASTM A 563-\, Grade C \-ASTM A 325-\, Type 3 with carbon steel nuts conforming to \-ASTM A 563-\, Grade C3. Bolts shall be load indicator type with spline separation to indicate predetermined tension as a load-indicating device as per AISC S334L.

2.5 *CARBON STEEL BOLTS AND NUTS*\

Carbon steel bolts shall conform to \-ASTM A 307-\, Grade A with carbon steel nuts conforming to \-ASTM A 563-\, Grade A.

2.6 *NUTS DIMENSIONAL STYLE*\

Carbon steel nuts shall be Heavy Hex Style when used with \-ASTM A 307-\ bolts or Heavy Hex style when used with \-ASTM A 325-\ bolts.

2.7 *WASHERS*\

Plain washers shall conform to \-ASTM F 844-\. Other types, when required, shall conform to \-ASTM F 436-\.

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 \-AISC-04-\. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified 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 12.7 micrometer as determined by \-ASME B46.1-\, and ends shall be square within the tolerances for milled ends specified in \-ASTM A 6-\. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with the \-AISC-04-\ and primed with the specified paint.

3.2 *ERECTION*\

Erection of structural steel shall be in accordance with the applicable provisions of \-AISC-04-\.

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. Installation of Load Indicator Bolts

Bolts used for structural steel shop and field connections shall be load indicator bolts. Installation of load indicator bolts shall be in accordance with the following procedure:

1. Use drift pins to align bolt holes and to maintain dimensions and plumbness of the structure.

2. Insert load indicator bolts in open holes and hand tighten nuts with an ASTM A325 hardened round washer under the nut.

3. Use the load indicator bolt wrench to "snug" up sufficient bolts to draw all plies of the connection into firm contact. Do <u>not</u> tighten any bolt sufficiently to cause spline separation.

4. Remove the drift pins and replace them with load indicator bolts.

5. Complete tightening all bolts until spline separation occurs. Bolts should be tightened progressively away from fixed or rigid points to the free edges.

3.2.3. Base Plates and Bearing Plates

| <u>[AM#2]</u> 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~~ nonshrink grout ~~is indicated on the drawings~~. Bedding mortar and grout shall be as specified in Section \=03300=\ CAST-IN-PLACE STRUCTURAL CONCRETE.

3.2.4. Field Welded Connections

Field welded structural connections shall be completed before load is applied.

3.2.5. Field Priming

After erection and within five working days after they are ispected and approved, the field bolt heads, nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 05210

STEEL JOISTS AND JOIST GIRDERS

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.

STEEL JOIST INSTITUTE (SJI)

\-SJI-01-\	(1994) Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders

1.2 SUBMITTALS

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

SD-04 Drawings\

Steel Joists\; *GA*\.

Detail drawings shall include fabrication and erection details, specifications for shop painting, and identification markings of joists and joist girders.

SD-13 Certificates\

Steel Joists\; *FIO*\.

Certificates stating that the steel joists and joist girders have been designed and manufactured in accordance with \-SJI-01-\. Complete engineering design computations may be submitted in lieu of the certification.

1.3 DESCRIPTION

Steel joists and joist girders are designated on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all other specified requirements are met.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition and stored off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling.

PART 2 - PRODUCTS

2.1 OPEN WEB STEEL JOISTS

Open web steel joists shall conform to \-SJI-01-\, K-Series. Joists shall be designed to support the loads given in the standard load tables of \-SJI-01-\.

2.2 JOIST GIRDERS

Joist girders shall conform to \-SJI-01-\.

2.3 ACCESSORIES AND FITTINGS

Accessories and fittings, including end supports and bridging, shall be in accordance with the standard specifications under which the members were designed.

2.4 SHOP PAINTING

Joists , joist girders and accessories shall be shop painted with a rust-inhibiting primer paint. For joists and joist girders which will be finish painted under Section \=09900=\ PAINTING, GENERAL, the primer paint shall be limited to a primer which is compatible with the specified finish paint.

PART 3 - EXECUTION

3.1 ERECTION

| [AM#2] Installation of joists and joist girders shall be in accordance with the standard specification under which the member was produced. Joists and joist girders shall be handled in a manner to avoid damage. Damaged joists and joist girders shall be removed from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Joists and joist girders shall be accurately set, and end anchorage shall be in accordance with the standard specification under which the joists and joist girders were produced. For spans over 12 m through 18 m one row of bridging nearest midspan shall be bolted diagonal bridging. Joist bridging and anchoring shall be secured in place prior to the application of any construction loads. Any temporary loads shall be distributed so that the carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging during construction or in the completed work.
| Abraded, corroded, and field welded areas shall be power tool cleaned per
| SSPC-SP3 and touched up with the same type and thickness of paint used in
| the shop painting within seven (7) days of the steel piece erection.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

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.

ALUMINUM ASSOCIATION (AA)

\-AA DAF-45-\	(1980) Designation System for Aluminum Finishes
\-AA SAA-46-\	(1978) Standards for Anodized Architectural Aluminum

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI A14.3-\	(1992) Ladders - Fixed - Safety Requirements
\-ANSI MH28.1-\	(1982) Design, Testing, Utilization, and Application of Industrial Grade Steel Shelving

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 36-\	(1994a) Carbon Structural Steel
\-ASTM A 53-\	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
\-ASTM A 123-\	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
\-ASTM A 283-\	(1993a) Low and Intermediate Tensile Strength Carbon Steel Plates
\-ASTM A 467-\	(1993) Machine and Coil Chain
\-ASTM A 475-\	(1989) Zinc-Coated Steel Wire Strand
\-ASTM A 500-\	(1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
\-ASTM A 653-\	(1994) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

\-ASTM A 924-\	(1994) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
\-ASTM B 26-\	(1995) Aluminum-Alloy Sand Castings
\-ASTM B 221-\	(1995a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
\-ASTM B 429-\	(1995) Aluminum-Alloy Extruded Structural Pipe and Tube
\-ASTM D 2047-\	(1993) Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine

AMERICAN WELDING SOCIETY (AWS)

\-AWS D1.1-\	(1994) Structural Welding Code - Steel

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

\-NAAMM MBG 531-\	(1988; MBG 531S-89) Metal Bar Grating Manual
\-NAAMM MBG 532-\	(1988) Heavy Duty Metal Bar Grating Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 211-\	(1992) Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances

1.2 SUBMITTALS

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

SD-04 Drawings\

Miscellaneous Metal Items\; *FIO*\.

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items:

a. Floor plates.
b. Handrails.
c. Ladders.
d. Miscellaneous
e. Partitions, diamond-mesh type.
f. Roof scuttles.
g. Steel door frames.

SD-14 Samples\

Miscellaneous Metal Items\; *GA*\.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with \-AWS D1.1-\. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with \-ASTM A 653-\, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

PART 2 PRODUCTS

2.1 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

2.2 HANDRAILS

Handrails shall be designed to resist a concentrated load of 890 N in any direction at any point of the top of the rail or 292 Newtons per meter applied horizontally to top of the rail, whichever is more severe.

2.2.1 Steel Handrails, Including Carbon Steel Inserts

Steel handrails, including inserts in concrete, shall be steel pipe conforming to \-ASTM A 53-\. Steel railings shall be 40 mm nominal size. Railings shall be shop painted. Pipe collars shall be steel.

a. Fabrication: Joint posts, rail, and corners shall be fabricated by one of the following methods:

(1) Flush type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 10 mm hexagonal recessed-head setscrews.

(2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 150 mm long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

b. Removable sections, toe-boards, and brackets shall be provided as indicated.

2.3 LADDERS

Ladders shall be galvanized steel or aluminum, fixed rail type in accordance with \-ANSI A14.3-\.

2.4 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

2.5 PARTITIONS, DIAMOND MESH TYPE

Partitions shall be constructed of metal fabric attached to structural steel framing members. Fabric shall be mesh with wire secured through weaving channels as indicated. Channel frames shall be mortised and tenoned at intersections. Steel frames, posts, and intermediate members shall be of the sizes and shapes indicated. Cast-iron floor shoes and caps shall have setscrew adjustment. Doors and grilles shall be provided as indicated, complete with hardware and accessories including sliding mechanisms, locks, guard plates, sill shelves and brackets, and fixed pin butts. Doors and grilles shall have cover plates as indicated. Dutch doors shall have a lock for each leaf. A continuous rubber bumper shall be provided at bottom of grille frame. Locks shall be bronze, cylinder, mortise type. Keying shall be coordinated with Section \=08700=\ BUILDERS' HARDWARE. Ferrous metal portions of partitions and accessories shall be galvanized and painted.

2.6 ROOF SCUTTLES

Roof scuttles shall be of galvanized steel as indicated on the drawings The curb shall be equipped with an integral metal cap flashing of the same gauge and metal as the curb, full welded and ground at corners for weathertightness. Scuttle shall be completely assembled with heavy hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles on inside and outside and neoprene draft seal. Fasteners shall be provided for padlocking on the inside. The cover shall be equipped with an automatic hold-open arm complete with handle to permit one hand release.

2.7 STEEL DOOR FRAMES

Steel door frames built from structural shapes shall be neatly mitered and securely welded at the corners with all welds ground smooth. Jambs shall be provided with 50 by 6 by 300 mm bent, adjustable metal anchors spaced not over 760 mm on centers. Provision shall be made to stiffen the top member for all spans over 900 mm. Continuous door stops shall be made of 38 by 16 mm bars.

2.8 WINDOW GUARDS, BAR GRILLE TYPE

Bar grill window guards shall be of 19 mm round bars, spaced not over 102 mm on centers vertically, and 50 by 13 mm horizontal bars spaced not over 300 mm on centers. Vertical bars shall be extended through and securely welded to the cross bars. Horizontal bars shall be extended, bent, and drilled as shown for anchorage at jambs of window openings.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

3.2 PIPE GUARDS

Pipe guards shall be set vertically in concrete piers. Piers shall be constructed of, and the hollow cores of the pipe filled with, concrete specified in SECTION \=03300=\ CAST-IN-PLACE STRUCTURAL CONCRETE. having a compressive strength of 21 MPa.

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.

3.3.1 Installation of Steel Handrails

Installation shall be by means of pipe sleeves secured to steel pipe flanges anchored by expansion shields and bolts.

3.4 PARTITION POSTS AND OPENINGS

Posts shall be set in shoes bolted to the floor and in caps tap-screwed to clip angles in overhead construction, as indicated. Openings shall be formed using channels similar to the partition frames at ducts, pipes, and other obstructions.

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 450 mm 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 TRENCH FRAMES AND COVERS

Trench frames and covers shall finish flush with the floor.

3.7 BAR-GRILLE WINDOW GUARDS

Bar-grille window guards shall be securely anchored to masonry with 13 mm diameter prison-type screws or bolts and expansion shields, or other type of fastenings if the ends of such fastenings are welded to the adjoining metal grilles or otherwise made tamperproof in a satisfactory manner. Spanner-head screws or bolts are not considered prison-type fasteners.

| 3.8 [AM#2] 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 350 x 500 mm (14 by 20 inches) and of not lighter than 14-gauge steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame and provided with a flush-face screw-driver-operated latch. Exposed metal surfaces shall have a shop-applied prime coat.
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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 07175

WATER REPELLANT COATING

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 666-\	(1992) Resistance of Concrete to Rapid Freezing and Thawing.
\-ASTM E 514-\	(1990) Water Penetration and Leakage Through Masonry

1.2 SUBMITTALS

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

SD-01 Data\

Water Repellant Coating\; *[FIO]*\.

Manufacturer's Catalog Data

Warranty\; *[FIO]*\.

Coating manufacturer's 5-year water repellent warranty against moisture penetration into the building, yellowing, and mildew at any location where the coating was applied. If the coating fails within the 5-year period, the manufacturer shall clean the affected area and furnish and reapply the coating over the entire wall area where the failure occurred, at no additional cost to the Government.

SD-06 Instructions\

Installation Procedures\; *[FIO]*\.

Manufacturer's descriptive data describing procedures for mixing and application shall be submitted for approval.

SD-09 Reports\

Water Repellant Coating\; *[FIO]*\.

Test reports by an independent testing laboratory attesting that the water repellent coating conforms to specified requirements shall be submitted.

SD-18 Records\

Bills of Lading\; *[FIO]*\.

Bills of lading or labels for each container shall indicate compliance with the applicable specification for the water repellant coating.

1.3 DELIVERY AND STORAGE

Water repellent coating shall be delivered to the project site in original sealed containers with manufacturer's name and brand clearly identified, shall be stored in dry locations with adequate ventilation, and shall be handled in a manner to prevent damage or contamination.

1.4 ENVIRONMENTAL CONDITIONS

Ambient temperature shall be above \^4 degrees C^\ \~40 degrees F~\ during application and for the duration of the curing period.

1.5 TEST AREA FOR APPROVAL

The water repellent coating, using specified methods and materials, shall be applied to the masonry sample panel for approval. The coating shall be visually and physically examined for penetration, bond, and loose materials. Failure of the coating to penetrate, bond, or the appearance of loose materials shall be cause for disapproval. Upon approval, the sample panel shall remain in place and open to observation as criteria for all water repellent coating for the project and as part of the work.

PART 2 - PRODUCTS

2.1 WATER REPELLENT COATING

Water repellent coating shall be a solvent based clear, non-yellowing, non-glossy, mildew resistant, deep penetrating, siloxane or silane type repellant designed for low-density, high-porosity surfaces. Solids content shall be 5 percent or greater. Volatile organic compound (VOC) content shall not exceed 480 grams per liter. There shall be no penetration or leakage of water through masonry when tested for 100 km/h wind driven water in accordance with ASTM E 514. When tested for resistance to rapid freeze-thaw in accordance with ASTM C 666, there shall be less than .006 per cent expansion in 45 cycles. <u>Water repellent coating shall be compatible with integral water repellent additive in concrete masonry units and mortar specified in Section \=04255=\ NONBEARING MASONRY VENEER/STEEL STUD WALL paragraphs 2.1.2.3 and 2.2.2.1.</u>

2.2 WATER

Water shall be potable and free from injurious amounts of oil, alkalis, acids, organic matter, and other deleterious substances.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES

Water repellent coating shall not be applied until masonry has been properly cleaned and is free of efflorescence, oil, grease, or other foreign matter detrimental to application. Defects shall be corrected and the surface shall be inspected and approved before the work is begun.

3.2 SURFACE PREPARATION

Remove loose particles and foreign matter. Remove grease or oil with a solvent, effective alkaline cleaner, or detergent as instructed by coating manufacturer. Scrub the surfaces with water. Allow the surfaces to dry prior to application.

3.3 APPLICATION

Apply the coating to exterior [concrete] [concrete masonry (smooth- or split-faced)] surfaces in accordance with the coating manufacturer's written instructions.

3.4 PROTECTION

Protect adjacent surfaces not scheduled to receive the coating. If applied on unscheduled surfaces, remove immediately in accordance with the approved manufacturer's written instructions.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

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 NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI A208.1-\	(1993) Particleboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM C 728-\	(1991) Perlite Thermal Insulation Board
\-ASTM C 984-\	(1994) Perlite Board and Rigid Cellular Polyurethane Composite Roof Insulation
\-ASTM C 1050-\	(1991) Rigid Cellular Polystyrene - Cellulosic Fiber Composite Roof Insulation
\-ASTM C 1289-\	(1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
\-ASTM D 41-\	(1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
\-ASTM D 312-\	(1995) Asphalt Used in Roofing
\-ASTM D 2178-\	(1989) Asphalt Glass Felt Used in Roofing and Waterproofing
\-ASTM D 4586-\	(1993) Asphalt Roof Cement, Asbestos Free
\-ASTM F 547-\	(1977; R 1990) Terminology of Nails for Use with Wood and Wood-Base Materials

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

\-FM P7825-\	(1995; Supple 1; Supple II; Supple III) Approval Guide
\-FM 4450-\	Standard for Roof Insulation

UNDERWRITERS LABORATORIES (UL)

\-UL-01-\	(1996) Building Materials Directory

\-UL 1256-\ (1993) Fire Test of Roof Deck Constructions

1.2 SUBMITTALS

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

SD-06 Instructions\

Application of Insulation\; *FIO*\.

Insulation manufacturer's recommendations for the application and installation of insulation.

SD-08 Statements\

Inspection\; *FIO*\.

The inspection procedure for insulation installation, prior to start of roof insulation work.

SD-13 Certificates\

Insulation\; *FIO*\.

Glass Roofing Felt\; *FIO*\.

Organic Roofing Felt\; *FIO*\.

Certificate attesting that the expanded perlite or polyisocyanurate insulation contains recovered material and showing estimated percent of recovered material. Certificates of compliance for felt materials.

1.3 STORAGE OF MATERIALS

Insulation, base sheet, and felt shall be kept dry at all times, before, during, and after delivery to the site and shall be stored in an enclosed building or in a closed trailer. Wet insulation, wet base sheet or wet felt shall be permanently removed from the site. Felts shall be stacked on end one level high. Felt rolls shall be maintained at a temperature above 10 degrees C for 24 hours immediately before laying.

1.4 FIRE CLASSIFICATION

Insulation shall have been tested as part of a roof construction assembly of the type used in this project and the construction shall be listed as Fire-Classified in \-UL-01-\ or Class I in \-FM P7825-\.

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, finished blowing temperature, 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 for horizontal surfaces; Type II for vertical surfaces.

2.1.3 Asphalt Primer

\-ASTM D 41-\.

2.2 *INSULATION*\

| [AM#2] 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 24 degrees C, 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~~R-19. The insulation manufacturing process shall not include chlorofluoro carbons (CFC) or formaldehydes. Insulation and fiberboard shall contain the highest practicable percentage of material which has been recovered or diverted from solid waste (e.g., postconsumer waste), but not including material reused in a manufacturing process. Where two materials have comparable price and performance, the one having the higher recovered material content shall be selected. Insulation shall be one, or a combination of the following materials:

2.2.1 Composite Board Insulation

\-ASTM C 726-\, or \-ASTM C 984-\ or \-ASTM C 1050-\ or \-ASTM C 1289-\ Type III, or \-ASTM C 1289-\ Type VI. Perlite, in composite board, may be replaced with \-ANSI A208.1-\ wood particle board, 11 mm minimum thickness, provided that the composite board meets specified physical requirements. Composite board with wood particle board shall conform to \-ASTM C 1289-\, Type V.

2.2.2 Expanded-Perlite Insulation Board

\-ASTM C 728-\ with a minimum recovered material content of 23 percent of the expanded perlite portion of the board.

2.2.3 Polyisocyanurate

\-ASTM C 1289-\, Type I, or \-ASTM C 1289-\ Type II, having minimum recovered material content of 9 percent by weight of the polyisocyanurate portion of the board. The insulation shall comply with requirements of \-FM4450-\ or \-UL 1256-\ for application of foam insulation directly to metal roof decking. The insulation bottom face shall be manufacturer's standard facer.

2.3 NAILS AND FASTENERS

Nails and fasteners shall conform to the following requirements:

2.3.1 Nails for Fastening Insulation to Wood Nailers

\-ASTM F 547-\ 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 178 N each in steel deck. Fasteners for steel or concrete decks shall conform to \-FM P7825-\ for Class I roof deck construction, and shall be spaced to withstand an uplift pressure of 4.3 kPa.

2.3.3 Metal Disks

Flat and not less than 0.39 mm thickness. Disks used with nails or fasteners for securing fiberboard insulation shall be minimum 25 mm diameter. Disks used with nails or fasteners for securing other board insulation shall be minimum 53 mm in diameter.

2.4 GLASS ROOFING FELT

\-ASTM D 2178-\, Type IV.

2.5 WOOD NAILERS

Wood nailers shall conform to Section \=06100=\ ROUGH CARPENTRY including preservative treatment. Edge nailers shall be not less than nominal 150 mm wide and of thickness to finish flush with the top surface of the insulation. Surface mounted nailers shall be a nominal 75 mm wide by the full thickness of the insulation.

PART 3 EXECUTION

3.1 COORDINATION REQUIREMENTS

Insulation and roofing membrane shall be finished in one operation up to the line of termination at the end of each day's work. Completed sections shall be waterproofed when more than one day is required to finish the roofing. Phased construction will not be permitted.

3.2 ENVIRONMENTAL CONDITIONS

Air temperature shall be above 4 Degrees C and there shall be no visible ice, frost, or moisture on the roof deck when the insulation and roofing are installed.

3.3 SUBSTRATE PREPARATION

The substrate construction of any bay or section of the building shall be completed before insulation or vapor retarder work is begun thereon. Insulation or vapor retarder applied directly on lightweight insulating concrete or gypsum shall not be scheduled until the insulating concrete passes the air-dry density test specified in Section \=03300=\ CAST-IN-PLACE STRUCTURAL CONCRETE. Insulation or vapor retarder applied directly on concrete shall not be scheduled until frothing or bubbling does

not occur when hot bitumen is applied to the concrete and until the hot bitumen sticks tightly to the concrete. 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 100 mm strip of roofing felt, embedded in and coated with asphalt cement. Substrate surface shall be smooth, clean, and dry at time of application.

3.4 HEATING OF ASPHALT

Asphalt shall not be heated higher than 42 degrees C above the EVT or 28 degrees C below the flash point, or 275 degrees C, whichever is lower. EVT and flash point temperatures of asphalt in the kettle shall be conspicuously posted on the kettle. Kettle shall be provided with automatic thermostatic controls and an accurate thermometer. Kettle operators shall be in attendance at all times during heating to ensure that the maximum temperature is not exceeded. Asphalt shall be applied within a range of 14 degrees C below or above the EVT, or as specified by the manufacturer. Application temperature shall be measured at the mop bucket or mechanical applicator. Asphalt at a temperature below this range shall be returned to the kettle. Flame-heated equipment shall not be placed on the roof.

3.5 INSTALLATION OF WOOD NAILERS

Nailers shall be secured to precast deck materials and to steel decks as indicated. Bolt anchors shall have nuts and washers countersunk, and bolts shall be cut flush with top of nailer. Powder-actuated fasteners, sized and spaced for nailer anchorage equivalent to that specified and indicated, may be used when approved. Surface mounted nailers shall be installed parallel with the roof slope and shall be spaced not over 1.2 meters face-to-face, except that where the insulation units are less than 1.2 meters in length the nailers shall be spaced to minimize cutting of the insulation.

3.6 *APPLICATION OF INSULATION*\

Insulation shall be laid in two or more layers. Units of insulation shall be laid in courses parallel with the roof slope. End joints shall be staggered. Insulation shall be cut to fit neatly against adjoining surfaces. Joints between insulation boards shall not exceed 6 mm. Joints in successive layers shall be staggered with respect to joints of preceding layer. Where insulation is applied over steel deck, long edge joints shall continuously bear on surfaces of the steel deck. Insulation which can be readily lifted after installation is not considered to be adequately secured. Insulation shall be applied so that all roof insulation applied each day is waterproofed the same day. Phased construction will not be permitted. Application of impermeable faced insulation shall be performed without damage to the facing.

3.6.1 Mechanical Fastening

On steel decks, or any slope exceeding 42 mm/m, the first layer of insulation shall be mechanically fastened. Method of attachment shall be in accordance with recommendations of the insulation manufacturer and requirements specified.

3.6.2 Steel Decks

Uninsulated steel decks shall have insulation applied to span the steel deck flutes and to act as an underlayment for the roof membrane. First layer of insulation on steel deck shall be compatible with mechanical fastening.

3.6.3 Foam Insulation

Polyisocyanurate foam insulations shall be isolated from built-up roof membrane by a separate or composite layer of perlite board.

3.6.4 Installation; Flat Roofs

Except for the first layer on steel deck, insulation layers shall be laid in solid moppings of hot asphalt applied at a rate of at least 0.97 kg per meter. Asphalt shall not be applied further than one panel length ahead of roof insulation being installed. Where roof slopes are greater than 42 mm/m, roof insulation shall be held in place by both asphalt mopping and mechanical fasteners. Asphalt primer shall be applied at the rate of 0.4 L/square meter over the entire surface to be mopped when the insulation is applied over concrete deck. The edges of insulation boards adjoining vented nailers shall be kept free of asphalt.

3.6.5 Installation; Curved Roofs

Mechanical fasteners are not permitted through metal roof deck. Coordinate and install insulation with sheet metal roofing. Fit insulation between metal channels. Plastic bituminous cement may be used to hole insulation in place temporarily. Prior to application of sheet metal roofing apply ice and water barrier over insulation and furring channels.

3.6.6 Protection Requirements

The insulation shall be kept dry at all times. Insulation boards shall not be kicked into position. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent. Cutoffs shall be 2 layers of bituminous-saturated felt set in plastic bituminous cement. Cutoffs shall be removed when work is resumed. Edges of insulation at open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, shall be protected until permanent roofing and flashing is applied. Storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces will not be permitted. Smooth, clean board or plank walkways, runways, and platforms shall be used, as necessary to distribute weight to conform to indicated live load limits of roof construction.

3.7 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.

b. Verification of certification, listing or label compliance with \-FM P7825-\.

c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.

e. Inspection of mechanical fasteners; type, number, length, and spacing.

f. Coordination with other materials, cants, sleepers, and nailing strips.

g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.

h. Installation of cutoffs and proper joining of work on subsequent days.

i. Continuation of complete roofing system installation to cover insulation installed same day.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 07412

NON-STRUCTURAL METAL ROOFING

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 463-\	(1994) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
\-ASTM A 653-\	(1995) Steel Sheet, Zinc-Coated (Galvantized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
\-ASTM A 792-\	(1995) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, General Requirements
\-ASTM B 117-\	(1994) Operating Salt Spray (Fog) Testing Apparatus
\-ASTM B 209-\	(1995) Aluminum and Aluminum-Alloy Sheet and Plate
\-ASTM D 522-\	(1993a) Mandrel Bend Test of Attached Organic Coatings
\-ASTM D 714-\	(1987; R 1994) Evaluating Degree of Blistering of Paints
\-ASTM D 968-\	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
\-ASTM D 1308-\	(1987; R 1993) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
\-ASTM D 1654-\	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
\-ASTM D 2244-\	(1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates
\-ASTM D 2247-\	(1994) Testing Water Resistance of Coatings in 100% Relative Humidity

\-ASTM D 2794-\	(1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
\-ASTM D 3359-\	(1995) Measuring Adhesion by Tape Test
\-ASTM D 4214-\	(1989) Evaluating the Degree of Chalking of exterior Paint Films
\-ASTM G 23-\	(1995) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

1.2 DESIGN LOADS

Wind uplift pressures are shown on contract drawings.

1.3 PERFORMANCE REQUIREMENTS

The metal roofing system supplied shall be suitable for the roof slope, the underlayment and uplift pressures shown on the contract drawings.

1.4 SUBMITTALS

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

SD-04 Drawings\

*Metal Roofing *\; *FIO*\.

Drawings consisting of catalog cuts, erection drawings, shop coating and finishing specifications, and other data as necessary to clearly describe materials, sizes, layouts, construction details, fasteners, and erection.

SD-13 Certificates\

Roof Panels\; *FIO*\.

Installation\; *FIO*\.

Accessories\; *FIO*\.

Contractor's Five Year Warranty\; *GA*\.

Certificates attesting that the panels and accessories conform to the requirements specified. Certificate for the roof assembly shall certify that the assembly complies with the material and fabrication requirements specified and is suitable for the installation at the indicated design slope. Certified laboratory test reports showing that the sheets to be furnished are produced under a continuing quality control program and that at least five (5) representative samples of similar material to that which will be provided on this project have been previously tested and have met the quality standards specified for factory color finish.

| [AM#2] *Manufacturer's Material Warranty*\; *GA*\.

SD-14 Samples\

Accessories\; *FIO*\.

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

Roof Panels\; *GA*\.

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

Fasteners\; *FIO*\.

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

Gaskets and Insulating Compounds\; *FIO*\.

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

Sealant\; *FIO*\.

One sample, approximately 0.5 kg, and descriptive data.

1.5 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weather tight coverings and kept dry. Material shall not be covered with plastic where such covering will allow sweating and condensation. Plastic may be used as tenting with air circulation allowed. Storage conditions shall provide good air circulation and protection from surface staining.

1.6 GUARANTEE

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

1.7 *CONTRACTOR'S FIVE YEAR WARRANTY*\

The NON-STRUCTURAL METAL ROOFING shall be warranted by the Contractor for a period of five (5) years against water leakage or any damage due to sustained winds up to and including the design wind as specified. The SSMRS covered under this warranty shall include the entire roofing system including but not limited to the standing seam metal roof panels, all of its accessories, components and trim, including all penetrations, such as pipe, vents, curbs, skylights, interior or exterior gutters and downspouts, and eave, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed to provide a weathertight roof system, including items specified

in other sections of these specifications, that become part of the NON-STRUCTURAL METAL ROOFING. All leaks and damage due to wind up to the design wind speed shall be repaired or replaced as approved by the Contracting Officer and shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor may supplement this warranty with written warranties from installer and/or manufacturer, which shall be submitted along with Contractor's warranty. However, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached example WARRANTY FOR NON-STRUCTURAL METAL ROOFING, and shall start upon final acceptance of the facility or the date the Government takes possession, whichever is earlier. It is understood that the contractor's Performance Bond will remain effective throughout the five (5) year Contractor's warranty period, for the entire NON-STRUCTURAL METAL ROOFING as outlined above.

PART 2 PRODUCTS

2.1 *ROOF PANELS*\

Panels shall be steel or aluminum and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length from eave to eave. Width of sheets shall provide nominal 300 mm to 450 mm of coverage in place. Design provisions shall be made for thermal expansion and contraction consistent with the type of system to be used. All sheets shall be either square-cut or miter-cut. Height of seams, at overlap of adjacent roof sheets shall be the building manufacturer's standard for the indicated roof slope, but not less than 35 mm.

2.1.1 Steel Panels

Zinc-coated steel conforming to \-ASTM A 653-\; aluminum-zinc alloy coated steel conforming to \-ASTM A 792-\, AZ 55 coating; or aluminum-coated steel conforming to \-ASTM A 463-\, Type 2, coating designation T2 65. Uncoated roof panels shall be 0.6 mm thick minimum. Panels shall be within 95% of the nominal thickness.

2.1.2 Aluminum Panels

Alloy conforming to \-ASTM B 209-\, temper as required for the forming operation, minimum 1.2 mm thick.

2.2 *ACCESSORIES*\

Accessories shall be compatible with the covering furnished. Flashing, trim, metal closure strips, caps, and similar metal accessories shall be not less than the minimum thicknesses specified for covering. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the covering and shall not absorb or retain water.

2.3 *FASTENERS*\

Fasteners for roof panels shall be zinc-coated steel, aluminum, or nylon capped steel, type and size as recommended by the manufacturer to meet the performance requirements. Fasteners for accessories shall be the

manufacturer's standard. Exposed roof fasteners shall be gasketed or have gasketed washers on the exterior side of the covering to waterproof the fastener penetration. Washer material shall be compatible with the covering; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 3 mm thick.

2.4 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on fluoropolymer enamel topcoat with an appropriate prime coat. Color shall match the color indicated on the drawings. The exterior coating shall be a nominal 0.025 mm thickness consisting of a polyvinylidene fluoride topcoat of not less than 0.018 mm dry film thickness and the paint manufacturer's recommended primer of not less than 0.005 mm thickness. The exterior color finish shall meet the test requirements specified below.

2.4.1 Salt Spray Test

A sample of the sheets shall withstand a salt spray test for a minimum of 1000 hours in accordance with \-ASTM B 117-\, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 8F, few no. 8 blisters, as determined by \-ASTM D 714-\; and a rating of 6, 3 mm failure at scribe, as determined by \-ASTM D 1654-\.

2.4.2 Formability Test

When subjected to testing in accordance with \-ASTM D 522-\, the coating film shall show no evidence of fracturing to the naked eye.

2.4.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested for a minimum of 1000 hours in accordance with \-ASTM G 23-\, Method 2, using a Type EH apparatus with cycles of 60 minutes radiation and 60 minutes condensing humidity. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with \-ASTM D 3359-\, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with \-ASTM D 4214-\ test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with \-ASTM D 2244-\.

2.4.4 Humidity Test

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

2.4.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with \-ASTM D 2794-\ equal to 1.5 times metal thickness in millimeters expressed in newton-meters, with no loss of adhesion.

2.4.6 Abrasion Resistance Test

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

2.4.7 Pollution Resistance

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

2.5 UNDERLAYMENTS

2.5.1 Rubberized Underlayment

Rubberized underlayment shall be equal to "Ice and Water Shield" as manufactured by Grace Construction Products, "Winterguard" as manufactured by CertainTeed Corporation, or "Weather Watch Ice and Water Barrier" as manufactured by GAF Building Materials Corporation.

2.5.2 Slip Sheet.

Slip Sheet shall be 0.24 kg per square meter rosin sized unsaturated building paper.

2.6 *SEALANT*\

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency.

2.7 *GASKETS AND INSULATING COMPOUNDS*\

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

PART 3 EXECUTION

3.1 *INSTALLATION*\

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

3.1.1 Roof Covering

Side laps shall be laid away from the prevailing winds. Side and end lap distances, joint sealing, and fastening and spacing of fasteners shall be in

accordance with manufacturer's standard practice. Spacing of exposed fasteners shall present an orderly appearance. Side laps and end laps of roof covering and joints at accessories shall be sealed. Fasteners shall be driven normal to the surface. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weathertight installation. Accessories shall be fastened into substrate, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction.

3.1.2 Attachment to Metal Roof Deck

When metal roofing panels are used with metal roof deck, the metal roofing shall be anchored through the metal roof deck into purlins or other roof members with bolts or screws. When metal roofing panels are anchored directly to metal roof deck, the manufacturer of the metal roof deck must be consulted on the proper attachment of the metal roofing panels. The contractor is required to provide data showing that the metal roof deck can resists a pullout force 2.25 times the load obtained from the tributary area of the metal roofing fastener.

3.1.3 Field forming of Roof Panels

Roofing panels may be formed from factory-color-finished steel coils at the project site, in which case the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.

3.1.4 Underlayment

Underlayment types shall be installed under metal roofing; they shall be installed directly over the insulation and furring channels. If a roof panel rests directly on the underlayments, a slip sheet shall be installed as a top layer, beneath the metal roofing panels, to prevent adhesion. All underlayments shall be installed so that successive strips overlap the next lower strip in shingle fashion. Underlayments shall be installed in accordance with the manufacturer's written instructions. The underlayments shall ensure that any water that penetrates below the metal roofing panels will drain outside of the building envelope.

ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

FIVE (5) YEAR WARRANTY
FOR
NON-STRUCTURAL METAL ROOFING

Project Description And Location (Include Bldg. No.): _____
Corps of Engineers Contract Number: _____
Specification Section Number & Description: _____
07412 NON-STRUCTURAL METAL ROOFING

Contractor: _____
Address: _____
Point Of Contact: _____
Telephone Number: _____

Owner: _____
Address: _____
Point of Contact: _____
Telephone Number: _____

Construction Agent: _____
Address: _____
Point of Contact: _____
Telephone Number: _____

The above facility is warranted by _____ for a period of five (5) years against leakage or any damage due to sustained winds up to and including the design wind speed of _____ kilometers per hour (km/hr). The NON-STRUCTURAL METAL ROOFING covered under this warranty shall include the entire roofing system including the standing seam metal roof panels, all of its accessories, components and trim, including all penetrations, such as pipe vents, curbs, skylights, interior or exterior gutters and downspouts, and eave, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed to provide a weathertight roof system, including items specified in other sections of the specifications, that are part of the NON-STRUCTURAL METAL ROOFING. All leaks and damage due to wind up to the design wind speed shall be repaired or replaced as approved by the Contracting Officer and shall cover the entire cost of repair or replacement, including all material, labor, and related markups. The above referenced warranty commenced on the date of final acceptance on _____ and remains in effect for stated duration from this date.

Signed, Dated, and Notarized (By Company President)

_____ _____
(Company President) (Date)

(See reverse side for supplemental provisions and exclusions)

ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

FIVE (5) YEAR WARRANTY
FOR
NON-STRUCTURAL METAL ROOFING

The Contractor may supplement this warranty with written warranties from the installer and/or manufacturer of the NON-STRUCTURAL METAL ROOFING, which shall be submitted along with the Contractor's Warranty. However, the Contractor will be ultimately responsible for the Warranty as outlined in the specifications and as indicated in this warranty example.

EXCLUSIONS FROM COVERAGE

1. Natural disasters, acts of God; lightning, fire, explosions, hurricanes, tornadoes, earthquakes, hail and sustained winds exceeding _____ kilometers per hour as recorded at the nearest meteorological center.

2. Acts of negligence or abuse or misuse by Government or other personnel, including accidents, vandalism, civil disobedience, war, or damage by falling objects.

3. Damage by structural failure, settlement, movement, distortion, warpage, or displacement of the building structure or alterations made to the building.

4. Corrosion caused by exposure to marine (salt water) atmosphere; constant spray of either salt or fresh water; corrosive chemicals, ash or fumes generated or released inside or outside the building from chemical plants, foundries, plating works, kilns, fertilizer factories, paper plants, and the like.

5. Failure of any part of the NON-STRUCTURAL METAL ROOFING due to the actions by the Owner to inhibit free drainage from the roof and allow ponding water. Contractor's design shall insure free drainage from the roof and not allow ponding water.

6. This warranty applies to the NON-STRUCTURAL METAL ROOFING, and does not include any consequential damage to the building interior or contents, but which shall be covered by the WARRANTY OF CONSTRUCTION clause included in this contract.

7. This warranty cannot be transferred to another Owner without written consent of the Contractor and this warranty and the contract provisions will take precedence over any conflicts with state statutes, unless otherwise approved in writing by the Contracting Officer.

Receipt of notice by telephone or in writing by the Owner or Contracting Officer that leaks or damage due to wind up to the design wind speed shall be responded to within 48 hours of receipt of notice. Emergency repairs to prevent further roof leaks shall be initiated immediately and written plan shall be submitted for approval to repair or replace the NON-STRUCTURAL METAL ROOFING. Actual work for permanent repairs or replacements shall be started within 30 days after receipt of notice, and completed within a reasonable time frame. If Contractor fails to adequately respond to the warranty provisions as stated in the contract and as contained herein the Contracting Officer may have the NON-STRUCTURAL METAL ROOFING repaired or replaced by others and charge the cost to the Contractor.

A framed copy of this warranty shall be posted in the mechanical room or other approved location during the entire warranty period.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

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 C 236-\	(1989; R 1993) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
\-ASTM C 976-\	(1990) Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box
\-ASTM D 2863-\	(1991) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
\-ASTM E 90-\	(1990) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
\-ASTM E 152-\	(1981a) Fire Tests of Door Assemblies
\-ASTM E 283-\	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

DOOR AND HARDWARE INSTITUTE (DHI)

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

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

\-NAAMM HMMA 865-\	(1992) Hollow Metal Manual; Section: Guide Specifications for Swinging Sound Control Hollow Metal Doors and Frames

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 80-\	(1992) Fire Doors and Windows
\-NFPA 80A-\	(1993) Protection of Buildings from Exterior Fire Exposures

\-NFPA 101-\	(1994) 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 \=01300=\ SUBMITTAL PROCEDURES:

SD-04 Drawings\

Steel Doors and Frames\; *FIO*\.

Drawings using standard door type nomenclature in accordance with \-SDOI SDI-106-\ indicating the location of each door and frame, elevation of each model of door and frame, details of construction, method of assembling sections, location and extent of hardware reinforcement, hardware locations, type and location of anchors for frames, and thicknesses of metal. Drawings shall include catalog cuts or descriptive data for the doors, frames, and weatherstripping including air infiltration data and manufacturers printed instructions.

SD-09 Reports\

Fire Rated Doors\; *FIO*\.

A letter by a nationally recognized testing laboratory which identifies the product manufacturer, type, and model; certifying that the laboratory has tested a sample assembly in accordance with \-ASTM E 152-\ and issued a current listing for same.

SD-13 Certificates\

Fire Rated Doors\; *GA*\.

Thermal Insulated Doors\; *FIO*\.

Sound Rated Doors\; *GA*\.

a. Certification of Oversized Fire Doors: Certificates of compliance in accordance with the requirements of \-ASTM E 152-\ for fire doors exceeding the sizes for which label service is available.

b. Certification of Sound and/or Thermal Insulating Rating: Certification or test report for sound rated and/or thermal insulated doors shall show compliance with the specified requirements. The

certification, or test report, shall list the parameters and the type of hardware and perimeter seals used to achieve the rating.

1.3 DELIVERY AND STORAGE

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

1.4 WARRANTY

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

PART 2 - PRODUCTS

2.1 DOORS AND FRAMES

| [AM#2] Doors and frames shall be factory fabricated in accordance with \-SDOI SDI-100-\ and the additional requirements specified herein. Door grade shall be heavy duty (Grade II) unless otherwise indicated on the door and door frame schedules. Exterior doors and frames shall be designation G60 galvanized. Doors and frames shall be prepared to receive hardware conforming to the templates and information provided under
| Section \=08702~~2~~0=\ BUILDERS' HARDWARE. Doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts as required. Doors and frames shall be reinforced for surface applied hardware. Frames shall be welded type. Door frames shall be furnished with a minimum of three jamb anchors and one floor anchor per jamb. Anchors shall be not less than 1.2 mm steel or 4.5 mm diameter wire. For wall conditions that do not allow the use of a floor anchor, an additional jamb anchor shall be provided. Rubber silencers shall be furnished for installation into factory predrilled holes in door frames; adhesively applied silencers are not acceptable. Where frames are installed in plaster or masonry walls, or required to be grouted, plaster guards shall be provided on door frames at hinges and strikes. Full glass doors shall conform to \-SDOI SDI-100-\, Model 3, and shall include provisions for glazing. Reinforcing of door assemblies for closers and other required hardware shall be in accordance with \-SDOI SDI-100-\ and the conditions of the fire door assembly listing when applicable. Exterior doors shall have top edges closed flush and sealed
| against water penetration. All exterior doors shall be thermally
| insulated in accordance with paragraph 2.3, Thermal Insulated Doors.

2.2 *FIRE RATED DOORS*\

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with \-ASTM E 152-\ and having a listing for the tested assemblies. The fire resistance rating shall be as shown. Doors exceeding the sizes for which listing label service is

offered shall be in accordance with \-ASTM E 152-\. Listing identification labels shall be constructed and permanently applied by a method which results in their destruction should they be removed.

2.3 *THERMAL INSULATED DOORS*\

The interior of thermal insulated doors shall be completely filled with rigid plastic foam permanently bonded to each face panel. The thermal conductance (U-value) through the door shall not exceed 2.33 W/sq m times K when tested as an operational assembly in accordance with \-ASTM C 236-\ or \-ASTM C 976-\. Doors with cellular plastic cores shall have a minimum oxygen index rating of 22 percent when tested in accordance with \-ASTM D 2863-\.

2.4 *SOUND RATED DOORS*\

Sound rated doors and frames shall be factory fabricated in accordance with \-NAAMM HMMA 865-\ and shall be provided at locations shown on the drawings. Door assemblies shall consist of 1.2 mm minimum thickness door, 1.7 mm minimum thickness frame, and adjustable perimeter seals. The Sound Transmission Class rating of the assembly shall be 45 when tested in accordance with \-ASTM E 90-\.

2.5 WEATHERSTRIPPING

[AM#2] Unless otherwise specified in Section \=08702~~2~~0=\ BUILDERS' HARDWARE, weatherstripping shall be as follows: Weatherstripping for head and jamb shall be manufacturer's standard elastomeric type of synthetic rubber, vinyl, or neoprene and shall be installed at the factory or on the jobsite in accordance with the door frame manufacturer's recommendations. Weatherstripping for bottom of doors shall be as shown. Air leakage rate of weatherstripping shall not exceed 0.31 l/s per linear meter of crack when tested in accordance with \-ASTM E 283-\ at standard test conditions. All exterior doors shall have weatherstripping installed per this paragraph.

2.6 LOUVERS

Where indicated, doors shall be provided with full louvers or louver sections. Louvers shall be sightproof type inserted into the door. Inserted louvers shall be stationary. Louvers shall be nonremovable from the outside of exterior doors or the unsecure side of interior doors. Insect screens shall be a removable type with 18 by 16 mesh aluminum or bronze cloth. Full louver doors shall be in accordance with \-SDOI SDI-100-\, Grade III, Model 3.

2.7 GLAZING

Glazing shall be as specified in Section \=08810=\ GLASS AND GLAZING. Removable glazing beads shall be screw-on or snap-on type.

PART 3 - EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with \-DHI-A115.IG-\. Preparation for surface applied hardware shall be in accordance with \-SDOI SDI-107-\.

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

3.1.1 Thermal Insulated Doors

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

3.1.2 Sound Rated Doors

Sound rated doors shall be installed in accordance with the manufacturer's printed instructions. Hardware and perimeter seals shall be adjusted for proper operation. Frames shall be filled solid with concrete grout.

3.2 FIELD PAINTED FINISH

Steel doors and frames shall be field painted in accordance with Section \=09900=\ PAINTING, GENERAL. Weatherstrips shall be protected from paint. Finish shall be free of scratches or other blemishes. Color shall be as specified on drawings.

3.3 DOOR FRAMES SET IN MASONRY WALLS

Where metal frames are in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the contact surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 08120

ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

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

ALUMINUM ASSOCIATION (AA)

\-AA DAF-45-\	(1980) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI A156.19-\	(1990) Power Assist and Low Energy Power Operated Doors.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

\-AAMA 605.2-\	(1992) Voluntary Specification for High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels
\-AAMA 1503.1-\	(1988) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM B 209-\	(1992a) Aluminum and Aluminum-Alloy Sheet and Plate
\-ASTM B 221-\	(1992a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
\-ASTM E 283-\	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
\-ASTM E 330-\	(1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

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

UNDERWRITERS LABORATORIES, INC. (UL)

\-UL 325-\ (1995) Door, Drapery, Gate, Louver, and Window Operators and Systems

1.1 SYSTEM DESCRIPTION

Swing-type aluminum doors and frames, of size and design shown on the drawings, shall be provided at the locations indicated. Doors shall be furnished complete with frames, subframes, transoms, adjoining sidelights, adjoining window wall, trim, and other accessories indicated and specified.

1.2 PERFORMANCE REQUIREMENTS

1.2.1 Vertical Rail Rotational Performance

Full-glazed doors, except doors with top and bottom rails fastened together with tensioned tie rods, shall pass the following test:

The test section shall consist of an assembly of the top corner of the door. The side-rail section shall be 609.6 mm long and the top-rail section shall be 304.8 mm long. The top-rail section of doors having tie rods extending between stiles shall have blocking at the section cut to provide anchorage for the tie rod. The top-rail section shall be anchored to the test bench so that the corner protrudes far enough to allow clearance for deflection of the side rail. A lever arm capable of supporting 845 N shall be attached to the side-rail section at a point 482.6 mm from the inside edge of the top-rail. Position of the lever arm shall be parallel to the top-rail section. A weight support pad shall be attached to the lever arm at a point 482.6 mm from the inner edge of the side rail. The test section shall withstand a load of 712 N on the lever arm before reaching the point of failure. Failure is defined as a joint separation of 1.6 mm during test loading or a vertical rail rotational displacement of 3-1/2 degrees during test loading.

1.2.2 Wind Load Performance

Doors shall be of sufficient strength to withstand a design wind load of 1440 Pa of supported area with a deflection of not more than 1/175 times the length of the member. Doors shall be tested in accordance with \-ASTM E 330-\ at a pressure not less than 1.5 times the design load.

1.3 SUBMITTALS

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

SD-01 Data\

Aluminum Doors and Frames\; *FIO*\.

Manufacturer's descriptive data and catalog cuts including air-infiltration data.

SD-04 Drawings\

Aluminum Doors and Frames\; *FIO*\.

A schedule showing the location of each door shall be included with the drawings. Drawings showing elevations of each door and frame type, details and method of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, and details of joints and connections.

SD-06 Instructions\

Installation\; *FIO*\.

Cleaning\; *FIO*\.

Manufacturers installation instructions and cleaning instructions.

SD-09 Reports\

Full-Glazed Doors\; *FIO*\.

For full-glazed doors, certified test reports stating that doors meet all test and specified requirements. Test shall be conducted by an independent testing laboratory within a period of 36 months preceding delivery of the doors to the site.

SD-19\ *Operation and Maintenance Manuals*\

Power Door Operator\; *GA*\.

Four copies of Operation and Maintenance Manuals, including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked. Manuals shall also include data for troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

1.4 DELIVERY AND STORAGE

Materials delivered to the jobsite shall be inspected for damage, and shall be unloaded with a minimum of handling. Storage shall be in a dry location with adequate ventilation, free from dust, water, and other contaminants, and which permits easy access for inspecting and handling. Materials shall be neatly stored on the floor, properly stacked on nonabsorptive strips or wood platforms. Doors and frames shall not be covered with tarps, polyethylene film, or similar coverings.

1.5 QUALITY ASSURANCE

1.5.1 Fire-Rated and Emergency Exit Operators

Provide door operators that comply with \-NFPA 80-\ requirements for doors as emergency exits, and do not interfere with fire ratings.

1.5.2 ANSI Standard

Provide power door operators that comply with applicable requirements of \-ANSI A156.19-\, Power Assist and Low Energy Power Operated Doors.

1.5.3 UL Standard

Provide power door operators that comply with \-UL 325-\.

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 ALUMINUM DOORS AND FRAMES

Extrusions shall comply with \-ASTM B 221-\, Alloy 6063-T5. Aluminum sheets and strips shall comply with \-ASTM B 209-\, alloy and temper best suited for the purpose. Fasteners shall be hard aluminum or stainless steel.

2.1.1 Finishes

Finish shall be clear anodized. Clear anodized finish shall be AA-M10C22A41 in accordance with the requirements of \-AA DAF-45-\.

2.1.2 Welding and Fastening

Where possible, welds shall be located on unexposed surfaces. Welds required on exposed surfaces shall be smoothly dressed. Welding shall produce a uniform texture and color in the finished work, free of flux and spatter. Exposed screws or bolts will be permitted only at inconspicuous locations and shall have heads countersunk.

2.1.3 Anchors

Anchors shall be stainless steel or steel with a hot-dipped galvanized finish. Anchors of the sizes and shapes required shall be provided for securing aluminum frames to adjacent construction. Anchors shall be placed near top and bottom of each jamb and at intermediate points not more than 625 mm apart. Transom bars shall be anchored at ends, and mullions shall be anchored at head and sill. Where indicated on the drawings, vertical mullion reinforcement shall be of sufficient length to extend up to the overhead structural slab or framing and be securely attached thereto. The bottom of each frame shall be anchored to the rough floor construction with 2.4 mm thick stainless steel angle clips secured to the back of each jamb and to floor construction. Stainless steel bolts and expansion rivets shall be used for fastening clip anchors. Freestanding door frames shall be reinforced and securely anchored to floor construction.

2.1.4 Provisions For Hardware

| [AM#2] Hardware for aluminum doors not specified in this Section is specified in Section \=08700=\ BUILDERS' HARDWARE. Hardware for revolving aluminum and glass doors is specified in Section \=08470=\ REVOLVING ENTRANCE DOORS. Doors and frames shall be cut, reinforced, drilled, and tapped at the factory to receive template hardware. Reinforcement shall be provided in the core of doors as required to receive locks, door closers, and other hardware. Doors to receive surface applied hardware shall be reinforced as required. Hardware for aluminum doors shall be products of the aluminum door manufacturer and shall be the manufacturer's premium hardware; the aluminum door manufacturer shall provide shop drawings/templates for all hardware attached to their doors.

2.1.5 Provisions For Glazing

Glazing shall be as specified in Section \=08810=\ GLASS AND GLAZING. Metal glazing beads, vinyl inserts, and glazing gaskets shall be provided for securing glass. Glass stops shall be tamperproof on exterior side.

2.1.6 Weatherstripping

Weatherstripping shall be continuous silicone-treated wool pile type, or a type recommended by the door manufacturer, and shall be provided on head and jamb of exterior doors. Weatherstripping for bottom of doors shall be as scheduled. Weatherstripping shall be easily replaced without special tools, and shall be adjustable at meeting stiles of pairs of doors. Air leakage rate of weatherstripping shall not exceed 0.775 L/s per lineal meter of crack when tested in accordance with \-ASTM E 283-\ at standard test conditions.

2.2 FABRICATION OF ALUMINUM FRAMES

Frames shall be double-glazed and shall have a minimum condensation resistance factor of 57 in accordance with \-AAMA 1503.1-\. Frames shall be fabricated of extruded aluminum shapes to contours as shown on the drawings. Shapes shown are representations of design, function, and required profile. Dimensions shown are minimum. Shapes of equivalent design may be submitted, subject to approval of samples. Minimum metal wall thickness shall be 2.29 mm, except glazing beads, moldings, and trim shall be not less than 1.27 mm. Frames that are to receive glass shall have removable snap-on glass stops and glazing beads. Joints in frame members shall be milled to a hairline watertight fit, reinforced, and secured mechanically by steel clip arrangement or by screw spline attachment.

2.3 FABRICATION OF ALUMINUM DOORS

2.3.1 Sizes, Clearances, and Edge Treatment

Doors shall be not less than 44.4 mm thick. Clearances shall be 1.6 mm at hinge stiles, 3 mm at lock stiles and top rails, and 5 mm at floors and thresholds. Single-acting doors shall be beveled 3 mm at lock and meeting stile edges. Double-acting doors shall have rounded edges at hinge stile, lock stile, and meeting stile edges.

2.3.1.1 Full-Glazed Stile and Rail Doors

Doors shall have medium stiles and rails as shown, and shall be fabricated from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Doors shall be single-glazed. Top and bottom rail shall be fastened together by means of welding or by 10 mm diameter cadmium-plated tensioned steel tie rods. An adjustable mechanism shall be provided in the top rail of narrow stile doors to allow for minor clearance adjustments after installation. Extruded aluminum snap-in glazing beads shall be provided on interior side of doors. Extruded aluminum theft-proof snap-in glazing beads or fixed glazing beads shall be provided on exterior or security side of doors. Glazing beads shall have vinyl insert glazing gaskets, designed to receive glass of thickness required. Glass is specified in Section \=08810=\ GLASS AND GLAZING.

2.4 LOW-ENERGY POWER OPERATED DOOR OPERATORS

2.4.1 Capacity

Provide operators of the size recommended by the manufacturer for the door size, weight, and movement, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for the type of occupancy indicated.

2.4.2 Exposed Housing

Exposed Housing: Minimum 1.57 mm thick extruded or formed aluminum cover with provisions for maintenance access. Provide fasteners that are concealed when door is in the closed position. Finish to match doors and frames.

2.4.3 Adjustment Features

Operators shall be fully adjustable. Provide adjustment for opening, closing, and checking speeds, as well as length of time the door remains open.

2.4.4 Electro-Mechanical Operators

Provide self-contained, concealed, overhead electro-mechanical drive unit, with power opening and closing, and checking for both opening and closing cycles. Include connections for power and control wiring. Provide safety release clutch for obstructed closing. Provide for normal manual opening when power is off. Provide operator with motor burnout protection for locked or otherwise inoperable doors.

2.4.5 Push-Button Switch

Activate low-energy power operator by interior and exterior frame mounted push-button switches. Manufacturer's standard door control switch recessed in aluminum framing. Provide each switch with blue plastic cover engraved with international symbol of accessibility and "Press Button to Open" white-lettered message.

2.4.6 Safety Device

Provide manufacturer's standard safety device(s) to prevent closing of door while pedestrian is in door opening and door swing area. Entry mat control device not permitted.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOORS, FRAMES, AND ACCESSORIES

3.1.1 Protection of Aluminum

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods.

3.1.1.1 Paint

Aluminum surfaces to be protected shall be solvent cleaned and given a coat of zinc-molybdate primer and one coat of aluminum paint.

3.1.1.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and shall be cemented to the aluminum surface using a cement compatible with aluminum.

3.1.2 *Installation*\

Frames and framing members shall be accurately set in position to receive doors, transoms, and adjoining sidelights. Frames shall be plumb, square, level, and in alignment, and securely anchored to adjacent construction. Metal-to-metal joints between framing members shall be sealed as specified in Section \=07920=\ JOINT SEALING. Doors shall be accurately hung with proper clearances, and adjusted to operate properly. Protective coverings if provided shall be removed and the doors and frames shall be thoroughly cleaned.

3.2 ALUMINUM DOOR HARDWARE SCHEDULE:

Key cylinder and other hardware for aluminum doors not specified in this Section is specified in Section \=08700=\ BUILDERS' HARDWARE. Hardware for revolving aluminum and glass doors is specified in Section \=08470=\ REVOLVING ENTRANCE DOORS.

AHW-1; DOORS A153B, A153C; EACH TO HAVE:

2	EA	BUTTS
1	EA	CLOSER
1	EA	LOW-ENERGY POWER OPERATOR
2	EA	PUSH BUTTON SWITCH "PRESS TO OPEN"
1	EA	EXIT DEVICE W/ LEVER
1	SET	WEATHERSTRIPPING
1	EA	SWEEP STRIP
1	EA	THRESHOLD

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AHW-2; DOORS A012A, A036A, A146A, B027A, B142A; EACH TO HAVE:

2	EA	BUTTS
1	EA	CLOSER
1	EA	EXIT DEVICE W/ LEVER
1	SET	WEATHERSTRIPPING
1	EA	SWEEP STRIP
1	EA	THRESHOLD
1	EA	WALL OR FLOOR STOP

AHW-3; DOORS A012B, A146B, B027B, B142B; EACH TO HAVE:

2	EA	BUTTS
1	EA	CLOSER
1	EA	OFFSET PULL
1	EA	PUSH BAR
1	SET	SILENCERS
1	EA	WALL OR FLOOR STOP

AHW-4; DOOR A036B; EACH TO HAVE:

2	EA	BUTTS
1	EA	CLOSER
1	EA	EXIT DEVICE W/ LEVER
1	SET	SILENCERS
1	EA	WALL OR FLOOR STOP

AHW-5; DOOR A174A, A178A; EACH TO HAVE:

4	EA	BUTTS
2	EA	CLOSERS
2	EA	EXIT DEVICES W/ LEVER
1	SET	WEATHERSTRIPPING
2	EA	SWEEP STRIPS
1	EA	THRESHOLD
2	EA	WALL OR FLOOR STOPS

AHW-6; DOOR A152, A166, A173; EACH TO HAVE:

4	EA	BUTTS
2	EA	CLOSERS
2	EA	EXIT DEVICES W/ LEVER
1	SET	SILENCERS
1	EA	WALL OR FLOOR STOP

AHW-7; DOOR A145, B023, B138; EACH TO HAVE:

2	EA	BUTTS
1	EA	CLOSER
1	EA	EXIT DEVICE W/ LEVER
1	SET	SILENCERS
1	EA	STOP

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AHW-8; DOOR A157, B022; EACH TO HAVE:

2	EA	BUTTS
1	EA	CLOSER
1	EA	DEADLOCKING LATCH W/ LEVER
1	EA	OFFSET PULL
1	EA	PUSH BAR
1	SET	SILENCERS
1	EA	WALL OR FLOOR STOP

AHW-9; DOOR A174B, B178B; EACH TO HAVE:

4	EA	BUTTS
2	EA	CLOSERS
1	EA	OFFSET PULL
1	EA	PUSH BAR
1	SET	SILENCERS
2	EA	WALL OR FLOOR STOPS

AHW-10; DOOR A158; EACH TO HAVE:

2	EA	BUTTS
1	EA	CLOSER
1	EA	OFFSET PULL
1	EA	PUSH BAR
1	SET	SILENCERS
1	EA	FLOOR STOP

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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.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM E 90-\	(1997) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
\-ASTM E 152-\	(1981a) Fire Tests of Door Assemblies

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

\-AWI-02-\	(1994) Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 80-\	(1992) Fire Doors and Windows
\-NFPA 101-\	(1994) Safety to Life from Fire in Buildings and Structures

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

\-NWWDA I.S. 1-A-\	(1993) Architectural 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 an "FIO" designation are for information only. The following shall be submitted in accordance with Section \=01300=\ SUBMITTAL PROCEDURES:

SD-04 Drawings\

Wood Doors\; *FIO*\.

Drawings indicating the location of each door, elevation of each type of door, details of construction, marks to be used to identify the doors, and location and extent of hardware blocking. Drawings shall include catalog cuts or descriptive data for doors, weatherstripping, and thresholds to be used.

SD-06 Instructions\

Fire Doors\; *FIO*\.

Manufacturers preprinted installation and touch-up instructions.

SD-13 Certificates\

Fire Rated Doors\; *GA*\.

Certificates for oversize fire doors stating that the doors are identical in design, materials, and construction to a door that has been tested and meets the requirements for the class indicated.

Sound Rated Doors\; *GA*\.

Certification or test report for sound rated doors shall show compliance with the specified requirements. The certifications, or test report, shall list the parameters and the type of hardware and perimeter seals used to achieve the rating.

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

| [AM#2] Hardware, including weatherstripping and thresholds, is specified
| in Section \=08702~~2~~0=\ BUILDERS' HARDWARE.

1.6 GLAZING

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

1.7 WARRANTY

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

PART 2 - PRODUCTS

2.1 GENERAL FABRICATION REQUIREMENTS

2.1.1 Edge Sealing

Wood end-grain exposed at edges of doors shall be sealed prior to shipment.

2.1.2 Adhesives

Adhesives shall be in accordance with \-NWWDA I.S. 1-A-\, requirements for Type II Bond Doors (water-repellent) 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.

2.2 FLUSH DOORS

Flush doors shall be solid core and shall conform to \-NWWDA I.S. 1-A-\, except for the one year acclimazation requirement in paragraph T-2, which shall not apply. Wood doors shall be 5-ply construction with faces, stiles, and rails bonded to the cores.

2.2.1 Core Construction

2.2.1.1 Solid Cores

Door construction shall be glued wood block core with vertical and horizontal edges bonded to the core.

2.2.2 Face Panels

2.2.2.1 Natural Finished Wood Veneer Doors

Veneer doors to receive natural finish shall be Premium Grade, Grade A, book matched rift cut, red oak veneer in accordance with \-NWWDA I.S. 1-A-\. Vertical stile strips shall be selected to provide edges of the same species and/or color as the face veneer. All interior wood doors shall be natural finish wood veneer doors. Door finish shall be in accordance with paragraph FIELD FINISHING.

2.3 *FIRE RATED DOORS*\

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with \-ASTM E 152-\ and having a listing for the tested assemblies. The specific time interval rating on the labels shall be as shown. Door assemblies shall be in accordance with

\-NFPA 80-\. Listing identification on labels shall be constructed and permanently applied by a method which results in their destruction should they be removed. Fire rated doors shall be mineral core with rating as required for door assembly rating indicated on the door schedule on the drawings.

2.3.1 Reinforcement Blocking

Fire rated doors shall be provided, as required, with hardware reinforcement blocking, and top, bottom, and intermediate rail blocking. Lock blocks shall be manufacturer's standard. Reinforcement blocking shall be in compliance with the manufacturer's labeling requirements. Reinforcement blocking shall not be of mineral material.

2.3.2 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.

2.4 SOUND RATED DOORS

Sound rated doors shall be provided at locations shown on the drawings. Door assemblies shall consist of solid core wood door, 14 gauge minimum thickness frame, and adjustable perimeter seals. The Sound Transmission Class rating of the assembly shall be 45 when tested in accordance with ASTM E 90.

2.5 MOULDING AND EDGING

Moulding and edging shall be as shown. Wood species for transparent finished doors shall match face veneer.

2.6 INSERT LOUVERS

Where indicated, doors shall be provided with sightproof insert louvers. Louvers shall be stationary or adjustable as shown. Blades shall be welded or tenoned to the frame and the entire assembly fastened to the door with metal or wood moldings on both sides as shown. The frame shall be nonremovable from the outside of the door. Wood mouldings shall match face veneer.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOORS

3.1.1 General Use Doors

Doors shall be fit, hung, and trimmed as required. Door shall have a clearance of 3 mm at the sides and top and shall have a bottom clearance of 6 mm over thresholds and 13 mm at other locations unless otherwise shown. The lock edge or both edges of doors shall be beveled at the rate of 3 mm in 50 mm. 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 *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 Sound Rated Doors

Sound rated doors shall be installed in accordance with the manufacturer's printed instructions. Hardware and perimeter seals shall be adjusted for proper operation Frames shall be filled solid with concrete grout.

3.3 FIELD FINISHING

Doors to receive field finishing, whether paint or natural finish, shall be factory primed or sealed, as required, and then shall be finished in accordance with Section \=09900=\ PAINTING, GENERAL. Factory applied sealer shall not prevent doors from accepting field stain and finish. Color shall be specified on drawings.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 08331

METAL ROLLING COUNTER 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 B 209-\	(1995) Aluminum and Aluminum-Alloy Sheet and Plate
\-ASTM B 221-\	(1995a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

\-NAAMM AMP 501-\	(1988) Metal Finishes Manual for Architectural and Metal Products; Section: Finishes for Aluminum

1.2 GENERAL

Rolling counter doors shall be of the type, size, and design indicated on the drawings, and shall be the standard product of a manufacturer regularly engaged in the production of rolling counter doors. 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 SUBMITTALS

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

SD-01 Data\

Rolling Counter Door Unit\; *FIO*\.

Counter and Frame; FIO.

Manufacturer's descriptive data and catalog cuts.

SD-04 Drawings\

Rolling Counter Door Unit\; *FIO*\.

Drawings including elevations of each door type, details of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, details of joints and connections, and details of guides and fittings. A schedule showing the location of each counter door shall be included with the drawings.

SD-06 Instructions\

Rolling Counter Door Unit\; *FIO*\.

Manufacturer's preprinted installation instructions.

SD-19 Operation and Maintenance Manuals\

Rolling Counter Door Unit\; *FIO*\.

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed. Spare parts data for each different item of material and equipment specified not later than six months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 year and 3 years of service.

1.4 DELIVERY AND STORAGE

Rolling counter doors shall be delivered to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Rolling counter doors shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants, and in a manner that permits easy access for inspecting 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 BASIC COMPONENTS

2.1.1 Curtain

The curtain shall be fabricated of minimum 1.27 mm thick extruded aluminum slats conforming to \-ASTM B 221-\, Alloy 6063. Slats shall be approximately 32 to 38 mm wide with a depth of crown of 13 mm. Alternate slats shall be fitted with end locks to maintain curtain alignment. Bottom of curtain shall be provided with angle or tubular bar reinforcement matching the curtain, and fitted with a resilient bottom seal.

2.1.2 Jamb Guides

Guides shall be of 3 mm minimum thickness extruded aluminum conforming to \-ASTM B 221-\, Alloy 6063, and shall be fitted with neoprene silencers or replaceable heavy nap striping to eliminate noise and dust infiltration.

2.1.3 Barrel

The curtain shall be coiled around a steel tube of sufficient thickness and diameter to prevent deflection exceeding 2.5 mm per meter. The barrel shall contain oil tempered torsion springs capable of counterbalancing the weight of the curtain. Springs shall be calculated to provide a minimum of 7,500 operating 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).

2.1.4 Counterbalance Assembly

Spring counterbalance shall be helical torsion type designed to include an overload factor of 25 percent and shall be grease packed and mounted in an inner shaft rod with grease sealed ball bearing units at each end.

2.1.5 Brackets

Brackets shall be a minimum 3 mm thick steel plate with provisions for bolting to the wall or to the guides.

2.1.6 Hood

The hood shall be of 1.02 mm minimum thickness aluminum sheet conforming to \-ASTM B 209-\, Alloy 5005.

2.1.7 Locks

| [AM#2] The curtain shall be locked at both sides of bottom bar by a chrome-plated cylinder lock keyed into the building keying system. Lock shall be on the room side of the counter door. Keying shall conform to
| Section \=08702~~2~~0=\ BUILDER'S HARDWARE.

2.2 ROLLING COUNTER DOOR (NON-RATED)

Rolling counter doors shall conform to the requirements specified herein and shall be constructed of aluminum curtains, guides and hood components.

2.3 OPERATION

2.3.1 Manual Operation

| [AM#2] The curtain shall be operated by means of manual push-up with two lift handles or continuous full width lift bar.

2.4 FINISH

Exposed parts of the counter door, including the curtain, bottom rail, guides, and hood shall be of uniform finish and appearance. Aluminum shall be given a clear satin anodized finish, AA-C22A31, in accordance with the \-NAAMM AMP 501-\.

PART 3 EXECUTION

3.1 INSTALLATION

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

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SECTION 08470

REVOLVING ENTRANCE 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.

ALUMINUM ASSOCIATION (AA)

\-AA DAF-45-\	(1980) Designation System for Aluminum Finishes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM B 209-\	(1992a) Aluminum and Aluminum-Alloy Sheet and Plate
\-ASTM B 221-\	(1992a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
\-ASTM E 283-\	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
\-ASTM E 330-\	(1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

1.2 SYSTEM DESCRIPTION

Revolving-type aluminum doors and frames, of size and design shown on the drawings, shall be provided at the locations indicated. Doors shall be furnished complete with manual door operators and controls, frames, subframes, transoms, adjoining sidelights, trim, and other accessories indicated and specified. Coordinate with work of Section \=08120=\ ALUMINUM DOORS AND FRAMES.

1.3 SUBMITTALS

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

SD-01 Data\

Revolving Doors and Frames\; *FIO*\.

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

SD-04 Drawings\

Revolving Doors, and Frames\; *FIO*\.

A schedule showing the location of each door shall be included with the drawings. Drawings shall indicate elevations of each door and frame type, full size sections, thickness and gauges of metal, fastenings, details of construction and operating hardware, operator and controls details.

SD-06 Instructions\

Installation\; *FIO*\.

Manual Door Operators\; *FIO*\.

Cleaning\; *FIO*\.

Manufacturers installation instructions and cleaning instructions.

SD-09 Reports\

Revolving Doors, and Frames\; *FIO*\.

Certified test reports stating that doors, frames, and operators meet all test and specified requirements. Test shall be conducted by an independent testing laboratory within a period of 36 months preceding delivery of the doors to the site.

SD-13 Certificates\

Revolving Doors\; *FIO*\.

Certificates shall state that the revolving doors conform to the specified requirements.

Warranty\; *GA*\

SD-14 Samples\

Finishes\; *GA*\

Samples of the anodized coating, showing the extreme color range.

SD-19 Operation and Maintenance Manuals\

Manual Door Operator\; *GA*\

Four copies of Operation and Maintenance manuals, including assembly, installation, operation and maintenance instructions, spare parts data which provides supplier name, current cost, catalog order number, and a

recommended list of spare parts to be stocked. Manuals shall also include data for troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of basic operating features, and routine maintenance requirements shall also be included. Documents shall be bound in a binder marked or identified on the spine and front cover. A table of contents page shall be included and marked with pertinent contract information and contents of the manual. Tabs shall be provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets shall be provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers.

1.4 PERFORMANCE REQUIREMENTS

Provide revolving entrance door assemblies that have the following capability based on testing manufacturer's standard units similar to those indicated for this Project:

Air Leakage: Not more than 6.4 L/s x sq. m of door area when tested at an inward pressure differential of 75 Pa according to ASTM E 283.

1.5 DELIVERY AND STORAGE

Materials delivered to the jobsite shall be inspected for damage, and shall be unloaded with a minimum of handling. Storage shall be in a dry location with adequate ventilation, free from dust, water, and other contaminants, and which permits easy access for inspecting and handling. Materials shall be neatly stored on the floor, properly stacked on nonabsorptive strips or wood platforms. Doors and frames shall not be covered with tarps, polyethylene film, or similar coverings.

1.6 STORAGE

Doors and frames shall be stored out of contact with the ground and under weathertight covering.

1.7 WARRANTY

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

PART 2 - PRODUCTS

2.1 REVOLVING ENTRANCE DOORS

Provide manufacturer's standard manual revolving entrance door assembly, complete with door wings, enclosure walls, ceiling, hardware, glass, controls, activation devices, safety devices, and accessories.

2.2 ALUMINUM DOORS AND FRAMES

Extrusions shall comply with \-ASTM B 221-\, Alloy 6063-T5. Aluminum sheets and strips shall comply with \-ASTM B 209-\, alloy and temper best suited for the purpose. Fasteners shall be hard aluminum or stainless steel.

2.2.1 Finishes

Finishes shall be clear anodized. Anodized finish shall be AA-M10C22A41 in accordance with the requirements of \-AA DAF-45-\. Finish shall match aluminum swing doors and frames and aluminum windows specified in Sections \=08120=\ and \=08520=\ respectifully and as specified on drawings.

2.2.2 Welding and Fastening

Where possible, welds shall be located on unexposed surfaces. Welds required on exposed surfaces shall be smoothly dressed. Welding shall produce a uniform texture and color in the finished work, free of flux and spatter. Exposed screws or bolts will be permitted only at inconspicuous locations and shall have heads countersunk.

2.2.3 Anchors

Anchors shall be stainless steel or steel with a hot-dipped galvanized finish. Anchors of the sizes and shapes required shall be provided for securing aluminum frames to adjacent construction. Anchors shall be placed near top and bottom of each jamb and at intermediate points not more than apart. Transom bars shall be anchored at ends, and mullions shall be anchored at head and sill. Where indicated on the drawings, vertical mullion reinforcement shall be of sufficient length to extend up to the overhead structural slab or framing and be securely attached thereto. The bottom of each frame shall be anchored to the rough floor construction with thick stainless steel angle clips secured to the back of each jamb and to floor construction. Stainless steel bolts and expansion rivets shall be used for fastening clip anchors. Freestanding door frames shall be reinforced and securely anchored to floor construction.

2.2.4 Provisions For Hardware

Doors and frames shall be cut, reinforced, drilled, and tapped at the factory to receive template hardware. Reinforcement shall be provided in the core of doors as required to receive locks, door operators, and other hardware. Doors to receive surface applied hardware shall be reinforced as required.

2.2.5 Hardware

| [AM#2] Exposed hardware shall be aluminum or stainless steel finished to
| match door finish. Provide lock cylinders and keying for revolving door so
| that the keying is compatible with the Building Keying System.

2.2.6 Provisions For Glazing

Glazing shall be as specified in Section \=08810=\ GLASS AND GLAZING. Metal glazing beads, vinyl inserts, and glazing gaskets shall be provided for securing glass. Revolving glass doors, including fixed sidelite panels shall be single glazed with fully tempered glass. Glass shall be 6 mm thickness. Glass in doors and sidelites shall be designated tempered glass by means of a permanent label visible in a lower corner of each panel.

2.3 FABRICATION OF ALUMINUM FRAMES

Frames shall be fabricated of extruded aluminum shapes to contours as shown on the drawings. Shapes shown are representations of design, function, and required profile. Dimensions shown are minimum. Shapes of equivalent

design may be submitted, subject to approval of samples. Minimum metal wall thickness shall be except glazing beads, moldings, and trim shall be not less than Frames that are to receive glass shall have removable snap-on glass stops and glazing beads. Joints in frame members shall be milled to a hairline watertight fit, reinforced, and secured mechanically by steel clip arrangement or by screw spline attachment.

2.3 FABRICATION OF REVOLVING DOORS

2.3.1 Sizes, Clearances, and Edge Treatment

Doors shall be not less than 44 mm thick. Clearances shall be at stiles, bottom and top rails, and at floors and thresholds.

2.3.1.1 Full-Glazed Stile and Rail Door Wings

Doors shall have medium stiles and rails, and shall be fabricated from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Doors shall be single-glazed. Top and bottom rail shall be fastened together by means of welding or by diameter cadmium-plated tensioned steel tie rods. Extruded aluminum snap-in glazing beads shall be provided on interior side of doors. Extruded aluminum theft-proof snap-in glazing beads or fixed glazing beads shall be provided on exterior or security side of doors. Glazing beads shall have vinyl insert glazing gaskets, designed to receive 6 mm thick glass. Glass is specified in Section \=08810=\ GLASS AND GLAZING. Two wings shall have maximum security deadbolts in bottom rail for locking doors and to receive lock cylinders specified in Section \=08700=\ BUILDER'S HARDWARE.

2.3.2 Manual Speed-Control Unit:

Mechanical speed regulator that allows free rotation of door wings up to a predetermined rate of speed and that engages a clutch-type brake to prevent rapid acceleration of door wings. Comply with the following:

a. Maximum Speed: 8 rpm.
b. Location: Recessed, floor mounted.

2.3.3 Panic-Collapsing Mechanism:

Manufacturer's standard device that permits all door wings to automatically release from their normal positions and move outward into the book-fold position when pressure is applied to outer stiles. Unit shall allow pressure adjustment from 445 to 800 N.

2.3.4 Push Bars:

Manufacturer's standard 25 mm diameter, #7 polished, stainless steel push bars.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOORS, FRAMES, AND ACCESSORIES

3.1.1 Protection of Aluminum

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods.

3.1.1.1 Paint

Aluminum surfaces to be protected shall be solvent cleaned and given a coat of zinc-molybdate primer and one coat of aluminum paint.

3.1.1.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and shall be cemented to the aluminum surface using a cement compatible with aluminum.

3.1.2 Installation

Frames and framing members shall be accurately set in position to receive doors, transoms, and adjoining sidelights. Frames shall be plumb, square, level, and in alignment, and securely anchored to adjacent construction. Doors shall be accurately hung with proper clearances, and adjusted to operate properly. Set tracks, header assemblies, operating brackets, rails, and guides level and true to location with adequate anchorage for permanent support.

3.2 ADJUSTING

After repeated operation of completed installation equivalent to 3 days use by normal traffic (100 to 300 cycles), readjust revolving entrance doors for optimum operating condition and safety, and for a weathertight closure. Lubricate hardware, operating equipment, and other moving parts.

3.3 CLEANING

Protective coverings if provided shall be removed and the doors and frames shall be thoroughly cleaned in accordance with manufacturer's recommendations.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

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 A117.1-\	(1998) Accessibile and Usable Buildings and Facilities

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM E 283-\	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
\-ASTM F 883-\	(1990) Padlocks

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

\-BHMA-01-\	(Effective thru Jun 1995) Directory of Certified Locks & Latches
\-BHMA-02-\	(Effective thru Jul 1995) Directory of Certified Door Closers
\-BHMA-03-\	(Effective thru Jul 1996) Directory of Certified Exit Devices
\-BHMA A156.1-\	(1988) Butts and Hinges
\-BHMA A156.2-\	(1989) Bored and Preassembled Locks and Latches
\-BHMA A156.3-\	(1994) Exit Devices
\-BHMA A156.4-\	(1992) Door Controls - Closers
\-BHMA A156.5-\	(1992) Auxiliary Locks & Associated Products
\-BHMA A156.6-\	(1994) Architectural Door Trim
\-BHMA A156.7-\	(1988) Template Hinge Dimensions
\-BHMA A156.8-\	(1994) Door Controls - Overhead Holders

\-BHMA A156.13-\	(1994) Mortise Locks & Latches
\-BHMA A156.15-\	(1995) Closer Holder Release Devices
\-BHMA A156.16-\	(1989) Auxiliary Hardware
\-BHMA A156.17-\	(1993) Self Closing Hinges & Pivots
\-BHMA A156.18-\	(1993) Materials and Finishes
\-BHMA A156.19-\	(1990) Power Assist and Low Energy Power Operated Doors
\-BHMA A156.20-\	(1989) Strap and Tee Hinges and Hasps
\-BHMA A156.21-\	(1989) Thresholds
\-BHMA A156.23-\	(1992) Electromagnetic Locks
\-BHMA A156.24-\	(1992) Delayed Egress Locks

DOOR AND HARDWARE INSTITUTE (DHI)

\-DHI-03-\	(1989) Keying Systems and Nomenclature
\-DHI-04-\	(1976) Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames
\-DHI-05-\	(1990) Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames
\-DHI-A115.IG-\	(1994) Installation Guide for Doors and Hardware
\-DHI A115-W-\	(Varies) Wood Door Hardware Standards (Incl All5-W1 thru A115-W9)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 80-\	(1995) Fire Doors and Windows
\-NFPA 101-\	(1994) Safety to Life from Fire in Buildings and Structures
\-NFPA 105-\	(1993) Smoke-Control Door Assemblies

1.2 SUBMITTALS

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

SD-01 Data\

Hardware and Accessories\; *FIO*\.

Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions. Spare parts data for locksets, exit devices, closers, electric locks, electric strikes, electro-magnetic closer holder release devices, and electric exit devices, after approval of the detail drawings, and not later than 6 month(s) prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-07 Schedules\

Hardware Schedule\; *FIO*\.

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

Keying Schedule\; *GA*\.

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

Schedule of Locked Drawers/Cabinets/Medical Casework\; *GA*\.

Framed schedule under plastic or glass of locations of all locked drawers, cabinets, medical casework in facility and corresponding key number.

SD-13 Certificates\

Hardware and Accessories\; *FIO*\.

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

Buy American Act Compliance\; *FIO*\

Furnish a separate certificate of compliance attesting that hardware items conform to the Section \=00700=\ CONTRACT CLAUSES pertaining to the "Buy American Act."

Warranty\; *FIO*\

SD-14 Samples\

Locksets\; *GA*\

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

1.3 PREDELIVERY CONFERENCE

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

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 SPECIAL TOOLS

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

1.6 \-WARRANTY-\

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

1.7 OPERATION AND MAINTENANCE MANUALS

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

PART 2 PRODUCTS

2.1 GENERAL HARDWARE REQUIREMENTS

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Hardware set numbers correspond to the set numbers shown on the drawings. Hardware items providing accessibility and usability for the phusically 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-\.

2.3.4 Spring Hinges

Spring hinges shall conform to \-BHMA A156.17-\.

2.3.5 Electric Hinges

Electric hinges shall conform to \-BHMA A156.1-\ with modification of added electric wires to insure correct operation of electric hardware items.

2.4 LOCKS AND LATCHES

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

2.4.1 Mortise Lock and Latchsets

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform to \-BHMA A156.13-\, operational Grade 1. Strikes for security doors shall be rectangular without curved lip. Mortise type locks and latches for doors 44 mm thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts.

2.4.2 Auxiliary Locks and Associated Products

Bored and mortise dead locks and latchsets shall conform to \-BHMA A156.5-\. Bolt and latch retraction shall be dead bolt style. Strike boxes shall be furnished with dead bolt and latch strikes for Grade 1.

2.4.3 Lock Cylinders (Mortise, Rim and Bored)

| [AM#2] Lock cylinders shall comply with \-BHMA A156.5-\. Lock cylinder
| shall have not less than ~~six~~seven pins. Cylinders shall have key removable type cores (series 1000, mortise locks only. A master keying system shall be provided. Construction interchangeable cores shall be provided. Disassembly of knob or lockset shall not be required to remove core from lockset. All locksets, exit devices, and padlocks shall accept same interchangeable cores.

2.4.4 Locksets for Lead-Shielded Doors

Locksets for lead-shielded doors shall be provided with factory-installed lead linings. Lead linings shall not be less than the thickness of the lead in the door in which the lockset is required.

2.4.5 Padlocks

Padlocks shall conform to \-ASTM F 883-\. Straps, tee hinges, and hasps shall conform to \-BHMA A156.20-\.

2.4.6 Lock Trim

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of \-BHMA A156.2-\ or \-BHMA A156.13-\, lever handles, roses, and escutcheons shall be 1.27 mm thick, if unreinforced. If reinforced, the outer shell shall be 0.89 mm thick and the combined thickness shall be 1.78 mm except that shanks shall be 1.52 mm thick. Lever handles shall be of plain design with ends returned to no more than 10 mm from the door face.

2.5 EXIT DEVICES AND EXIT DEVICE ACCESSORIES

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

2.5.1 Exit Devices and Auxiliary Items

Trim shall be of wrought construction and commercial plain design with straight, beveled, or smoothly rounded sides, corners, and edges. Adjustable strikes shall be provided for rim type and vertical rod devices. Open back strikes shall be provided for pairs of doors with mortise and vertical rod devices; except open back strikes shall be used on labeled

doors only where specifically provided for in the published listings. Touch bars shall be provided in lieu of conventional crossbars and arms. Escutcheons shall be provided not less than 175 by 55 mm. Escutcheons shall be cut to suit cylinders and operating trim.

2.6 KEYING

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

Locks:	3 change keys each lock.
Master keyed sets:	10 keys each set.
Construction keys:	10 total.
Blank keys:	100 total.

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

2.7 DOOR CLOSING DEVICES

Door closing devices shall conform to \-BHMA A156.4-\, Grade 1, and \-ANSI A117.1-\. Closing devices shall be products of one manufacturer for each type specified. Closers shall have the closing force set for a push-pull of 22 N applied at the handle for interior doors; for exgerior doors, set to the minimum required to relatch the door.

2.7.1 Surface Type Closers

Surface type closers shall be Grade 1, Series C02000 Full Cover 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.

2.7.2 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.

2.8 DOOR CONTROLS - OVERHEAD HOLDERS

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

2.9 ARCHITECTURAL DOOR TRIM

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

2.9.1 Door Protection Plates

2.9.1.1 Kick Plates

Kick plates shall be Type J100 stainless steel. Width of plates shall be 50 mm less than door width for single doors and 25 mm less for pairs of doors. Height shall be 400 mm, except where the bottom rail is less than 400 mm the plate shall extend to within 13 mm of the panel mold or glass bead. Edges of plates shall be beveled.

2.9.2 Push Plates

2.9.2.1 Combination Push-Pull Plates

Combination push-pull plates shall be Type J303, 1.27 mm thick minimum stainless steel beveled four edges.

2.9.2.2 Flat Plates

Flat plates shall be Type J300 1.27 mm thick stainless steel, size as noted. Edges of metal plates shall be beveled.

2.9.3 Door Pulls and Push/Pull Units

2.9.3.1 Arm Pulls

Arm pulls shall be Category J400, double base, stainless steel, with bevel edges.

2.9.3.2 Door Pulls

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

2.9.4 Push and Pull Bars

Push and pull bars shall be Category J500, stainless steel. Edges of mounting plates shall be beveled.

2.10 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. Dust-proof strikes shall be Type L04011 for doors that are not fire rated. Dust-proof strikes shall be Type L04021 for fire rated doors. Other auxiliary hardware of the types listed below, shall conform to \-BHMA A156.16-\.

Garment Hooks:	Garment Rods:
Hand Rail Brackets:	Coat Hook:

2.11 MISCELLANEOUS

2.11.1 Automatic Door Bottoms

Automatic door bottoms shall be surface type with aluminum housing cover, anodized clear finish. Door bottom shall have a wool, felt, rubber, vinyl, or neoprene seal and shall be actuated by the opening and closing of the door. The door bottom shall exclude light when the door is in the closed position and shall inhibit the flow of air through the unit.

2.11.2 Metal Thresholds

Thresholds shall conform to \-BHMA A156.21-\. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping. Thresholds for use with floor closers shall conform to \-BHMA A156.4-\. Latching thresholds shall conform to \-BHMA A156.3-\, Type 26, and of such height that the bottom of the door shall be 3 mm over the tread of the threshold and 3 mm below the top of the stop. Where required, thresholds shall be modified to receive projecting bolts of flush bolts and exit devices. Thresholds shall be beveled with slopes not exceeding 1:2 and with heights not exceeding 13 mm. Air leakage rate of weatherstripping shall not exceed 0.775 liters per second per lineal meter of crack when tested in accordance with \-ASTM E 283-\ at standard test conditions.

2.11.3 Rain Drips

Extruded aluminum, not less than 1.78 mm thick, clear anodized. Door sill rain drips shall be 38 mm to 44 mm high by 16 mm projection. Overhead rain drips shall be approximately 38 mm high by 63 mm projection and shall extend 50 mm on either side of the door opening width.

2.11.4 Aluminum Housed Type Weatherseals

Weatherseals of the type indicated shall consist of extruded aluminum retainers not less than 1.78 mm wall thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be clear (natural) 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 0.775 liters per second per lineal meter of crack when tested in accordance with \-ASTM E 283-\ at standard test conditions.

2.11.5 Gasketing

Gasketing shall be a compression type seal, silicon based, self-adhesive product for use on steel door frames with wood and steel doors for 20-minute and 45 minute C-label. Color shall be white. Air leakage rate of weatherstripping shall not exceed 0.775 liters per second per lineal meter of crack when tested in accordance with \-ASTM E 283-\ at standard test conditions.

2.11.6 Door Status Switch Assembly

Door status switch assembly shall sense and signal open and closed position of door. Assembly shall be flanged flush mounted magnetic contact SPDT switch for hollow metal frames and lead lined wood door. Contact shall be

rated not less than 0.3 amps at 30 VDC with color code leads. Door status switch assembly shall interface with X-ray duct system and controller specified in Section \=13090=\ X-RAY SHEILDING.

2.11.7 Key Control Storage System

Key control storage system shall conform to \-BHMA A156.5-\, JSN E8341, capacity equal to number of keyed locks, including change and master key sets, plus 10 percent, and shall be properly labeled for key identification. Set up, identification labeling and location of the key control storage shall be as directed at the Predelivery Conference.

2.12 FASTENINGS

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

2.13 FINISHES

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

2.14 HARDWARE FOR FIRE DOORS

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

2.15 COMPUTERIZED KEY CONTROL

Computerized key control system shall provide for documenting, issuing, and controlling keys and cores of all types. System shall have the capability to store on the computer a complete description of all keyed items, including index numbers, location of openings, lock manufacturer, key number, related master keys and grand master keys, total number of existing keys, and number of keys currently on loan.

System shall include software package only, compatible with 486DX33mz or greater, microcomputer. The computerized key and core control management software program shall be capable of future expansion and shall be user friendly, compatible with IBM PC's and must be Windows driven. Doors, cores and keys shall be pre-indexed into the software after final keying meetings.

PART 3 EXECUTION

3.1 APPLICATION

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

3.1.1 Hardware for Fire Doors and Smoke-Control Door Assemblies

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

3.1.2 Door-Closing Devices

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

3.1.3 Key Control Storage Systems

Key control storage system shall be installed where directed furnished to the Contracting Officer.

3.1.4 Kick Plates and Mop Plates

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

3.1.5 Auxiliary Hardware

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

3.1.6 Thresholds

Thresholds shall be secured with a minimum of three fasteners per single door width and six fasteners per double door width with a maximum spacing of 300 mm. Exterior thresholds shall be installed in a bed of sealant with expansion anchors and stainless steel screws, except that bronze or anodized bronze thresholds shall be installed with expansion anchors with brass screws. Minimum screw size shall be No. 10 length, dependent on job conditions, with a minimum of 19 mm thread engagement into the floor or anchoring device used. Thresholds shall have ends scribed neatly to jambs.

3.1.7 Rain Drips

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

3.1.8 Weatherseals

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

3.1.9 Gasketing

Gasketing shall be installed at the inside edge of the hinge and head and latch sides of door frame. Frames shall be toleranced for a 3 mm clearance between door and frame. Frames shall be treated with tape primer prior to installation.

3.2 \+OPERATIONAL TESTS+\

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

3.3 HARDWARE SETS

Proprientary products (National Guard, Stanley and Simplex/Unican) are for identification only. Similar equal products by other manufacturers may be submitted.

HW-1 EACH TO HAVE:

EA	CYLINDERS		E09211 OR E09221

PROVIDE PROPER TYPE AND QUANTITY OF CYLINDERS TO OPERATE THE SPECIFIED LOCK OR PANIC DEVICE.

- BALANCE OF HARDWARE BY DOOR SUPPLIER -

HW-2; EACH TO HAVE:

4	PR	BUTTS	A2133
4	EA	LOCK	F05
1	EA	DEADLOCK	E6071
2	EA	FLUSH BOLTS	L14081
2	EA	O.H. STOPS	C02511
1	EA	THRESHOLD	J36300
1	ST	GASKETING	(NATIONAL GUARD) 5050

HW-3 - NOT USED -

HW-4; EACH TO HAVE:

1.5	PR	BUTTS	A8112
1	EA	LOCK	F81
1	EA	CLOSER	C02051
1	EA	KICK PLATE	J102
1	EA	STOP	L22251

HW-5; EACH TO HAVE:

1.5	PR	BUTTS	A8112
1	EA	LOCK	F84
1	EA	CLOSER	C02011
1	EA	KICK PLATE	J102
1	EA	STOP	L22101

HW-6; EACH TO HAVE:

1.5	PR	BUTTS	A8133
1	EA	LOCK	F84
1	EA	STOP	L22101

HW-7; EACH TO HAVE:

1.5	PR	BUTTS	A8133
1	EA	LATCH	F75
1	EA	STOP	L22101

HW-8; EACH TO HAVE:

1.5	PR	BUTTS	A8133
1	EA	PRIVACY LOCK	F76
1	EA	STOP	L22251

HW-9; EACH TO HAVE:

1.5	PR	BUTTS	A8133
1	EA	LOCK	F81
1	EA	STOP	L22251

HW-10; EACH TO HAVE:

1.5	PR	BUTTS	A8112
1	EA	PULL	J402
1	EA	PUSH PLATE	J304 100 mm by 400 mm
1	EA	CLOSER	C02011
1	EA	KICK PLATE	J102
1	EA	STOP	L22101

HW-11; EACH TO HAVE:

1.5	PR	BUTTS	A8111
1	EA	DEADLOCK	E6071
1	EA	PULL	J402
1	EA	PUSH PLATE	J304 100 mm by 400 mm
1	EA	CLOSER	C02051
1	EA	KICK PLATE	J101
1	EA	STOP	L22101

HW-12; EACH TO HAVE:

1	ST	PIVOTS	C07111/3530B MODIFIED
1	EA	INTERMEDIATE PIVOT	C07311
1	EA	LOCK	F84 LEADLINED
1	EA	O.H. STOP	C85531
1	EA	DOOR STATUS SWITCH ASSEMBLY	67905-HM

HW-13 - NOT USED -

HW-14 - NOT USED -

HW-15 - NOT USED -

HW-16 - NOT USED -

HW-17; EACH TO HAVE:

1	ST	PIVOTS	A2742
1	EA	PRIVACY LOCK	F02
1	EA	EMERGENCY STRIKE	(STANLEY) DLS-1
1	EA	STOP	A1882

HW-18; EACH DOOR TO HAVE:

1.5	PR	BUTTS	A8133
1	EA	LATCH	F01
1	EA	O.H. STOP	C02511

HW-19; EACH TO HAVE:

1	ST	PIVOTS	C07111/3530B MODIFIED
1	EA	INTERMEDIATE PIVOT	C07311
1	EA	PRIVACY LOCK	
1	EA	O.H. STOP	C85531

HW-20; EACH TO HAVE:

1.5	PR	BUTTS	A8112
1	EA	DEADLOCK	E6071
1	EA	PULL	J402
1	EA	PUSH PLATE	J304 100 mm by 400 mm
1	EA	CLOSER	C02011
1	EA	KICK PLATE	J102
1	EA	STOP	L02161

HW-21; EACH TO HAVE:

1.5	PR	BUTTS	A8112
1	EA	CYPHER LOCK	(SIMPLEX) L1021 X (KEY BYPASS AS REQUIRED)
1	EA	DEADLOCK	E6071
1	EA	CLOSER	C02011
1	EA	KICK PLATE	J102
1	EA	STOP	L02251

HW-22; EACH TO HAVE:

1.5	PR	BUTTS	A8112
1	EA	PRIVACY LOCK	F02
1	EA	CLOSER	C02011
1	EA	KICK PLATE	J102

EXTERIOR, OUTSWINGING DOORS ARE TO HAVE NON-REMOVABLE PINS (NRP) AND LOCKING OUTSWINGING INTERIOR DOORS TO HAVE NRP.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

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 NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI A 118.9-\	(1992) Test Method and Specifications for Cementitious Backer Units

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 580-\	(1995a) Stainless and Heat Resisting Steel Wire
\-ASTM A 853-\	(1993) Steel Wire, Carbon, for General Use
\-ASTM C 36-\	(1995) Gypsum Wallboard
\-ASTM C 79-\	(1994) Gypsum Sheathing Board
\-ASTM C 475-\	(1994) Joint Compound and Joint Tape for Finishing Gypsum Board
\-ASTM C 630-\	(1993) Water-Resistant Gypsum Backing Board
\-ASTM C 645-\	(1995) Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board
\-ASTM C 665-\	(1994) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
\-ASTM C 754-\	(1988) Installation of Steel Framing Members to Receive Screw-Attached Gypsum
\-ASTM C 840-\	(1995) Application and Finishing of Gypsum Board
\-ASTM C 1002-\	(1993) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

\-FM P8016-\	(1995) Specification Tested Products Guide

GYPSUM ASSOCIATION (GA)

\-GA 600-\ (1994) Fire Resistance Design Manual

UNDERWRITERS LABORATORIES (UL)

\-UL-05-\ (1996; Supple) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

1.2.1 Fire-Rated Construction

Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL requirements, and as required to meet pressurization requirements. Penetrations through rated partitions and ceilings shall be sealed tight with rated firestopping materials. Fire ratings shall be as indicated.

1.3 SUBMITTALS

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

SD-04 Drawings\

Steel Framing\; *FIO*\.

Control Joints\; *FIO*\.

Fire-Resistant Assemblies\; *FIO*\.

Drawings and installation details for ceiling framing, furring, special wall framing, and framed openings in walls and ceilings.

SD-13 Certificates\

Gypsum Wallboard\; *FIO*\.

Water-Resistant Gypsum Board\; *FIO*\.

Exterior Gypsum Soffit Board\; *FIO*\.

Steel Framing\; *FIO*\.

Certificates stating that the steel framing and gypsum wallboard meet the specified requirements.

SD-14 Samples\

Texture Coating; GA

Three samples indicating range of light orange peel texture applied to 200 mm by 300 mm gypsum board. Submittal sample must be approved by the Contracting officer prior to proceeding with the work.

1.4 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 10 years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 5 years of documented successful experience.

1.5 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered in original containers bearing the name of manufacturer, contents, and brand name. Materials shall be stored off the ground in a weathertight structure for protection. Gypsum boards shall be stacked flat, off floor and supported to prevent sagging and warpage. Adhesives and joint materials shall be stored in accordance with manufacturer's printed instructions. Damaged or deteriorated materials shall be removed from jobsite.

1.6 ENVIRONMENTAL CONDITIONS

Environmental conditions for application and finishing of gypsum board shall be in accordance with \-ASTM C 840-\. During the application of gypsum board without adhesive, a room temperature of not less than 4 degrees C shall be maintained. During the application of gypsum board with adhesive, a room temperature of not less than 10 degrees C shall be maintained for 48 hours prior to application and continuously afterwards until completely dry. Building spaces shall be ventilated to remove water not required for drying joint treatment materials. Drafts shall be avoided during dry hot weather to prevent materials from drying too rapidly.

PART 2 MATERIALS

2.1 INTERIOR NON-LOADBEARING STUD WALLS

2.1.1 Studs

| [AM#2] Studs for non-loadbearing walls shall conform to \-ASTM C 645-\. Studs shall be prefabricated steel, C-shaped, punched web for utility access, G60 hot-dip galvanized after fabrication. Provide gauges as
| indicted on drawings. Prior to installation of gypboard on metal studs,
| the Q.C. shall confirm in writing that all wall reinforcement per detail
| #12 on Sequence #080 has been installed for all wall mounted equipment.

2.1.2 Runner Tracks

Floor and ceiling runner tracks shall conform to \-ASTM C 645-\. Tracks shall be prefabricated, U-shaped with minimum 22 mm flanges, unpunched web, gauge to match studs, G60 hot-dip galvanized after fabrication.

2.2 SUSPENDED CEILING FRAMING

Main carrying channels and cross furring members for suspended gypsum board ceilings shall conform to \-ASTM C 645-\. Carrying channels shall be formed from 1.519 mm thick cold-rolled steel, hot-dipped galvanized after fabrication, 38 by 19 mm deep. Furring members shall be formed from cold-rolled steel, hot-dip galvanized after fabrication, 19 mm high by 19 mm deep.

2.3 GYPSUM BOARD

Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length.

2.3.1 Fire-Rated Gypsum Board

Fire-rated gypsum board shall conform to \-ASTM C 36-\, and shall be Type X, 1200 mm wide. Fire-rated gypsum board shall be used throughout the project.

2.3.2 *Water-Resistant Gypsum Board*\

Water-resistant gypsum board shall conform to \-ASTM C 630-\, Type X, with water-resistant paper faces, paintable surfaces, and shall be 1200 mm width and maximum permissible length.

2.3.3 *Exterior Gypsum Soffit Board*\

Exterior gypsum soffit board shall conform to \-ASTM C 931-\, Type X, 1200 mm wide.

2.3.4 Cementitious Backer Board

Cementitious backer board shall conform to ANSI A 118.9 shall be 1200 mm wide.

2.4 ACCESSORIES

2.4.1 Taping and Embedding Compound

Taping and embedding compound shall conform to \-ASTM C 475-\. Compound shall be specifically formulated and manufactured for use in embedding tape at gypsum wallboard joints and fastener heads, and shall be compatible with tape and substrate.

2.4.2 Finishing or Topping Compound

Finishing or topping compound shall conform to \-ASTM C 475-\. Compound shall be specifically formulated and manufactured for use as a finishing compound for gypsum board.

2.4.3 All-Purpose Compound

All-purpose compound shall be specifically formulated and manufactured to use as a taping and finishing compound, and shall be compatible with tape and substrate.

2.4.4 Joint Tape

Joint tape shall conform to \-ASTM C 475-\ and shall be as recommended by gypsum board manufacturer.

2.4.5 Screws

Screws shall conform to \-ASTM C 1002-\. Screws shall be self-drilling and self-tapping steel, Type G for gypsum board to gypsum board, and Type S for wood or light-gauge steel framing.

2.4.6 Hangers

Suspended ceiling runner channel hangers shall be soft, annealed steel wire not less than 4 mm nominal diameter, conforming to \-ASTM A 853-\ or flat iron or steel straps, at least 2 by 22 mm size, coated with zinc, cadmium, or rust-inhibiting paint.

2.4.7 Fastenings

Tie wire, clips, rings, and other fastenings shall be corrosion-resisting steel conforming to \-ASTM A 580-\, composition 302, 304, or 316, Condition A, or nickel-copper alloy conforming to \-ASTM B 164-\, annealed condition except that walls, partitions, and other vertical surfaces not incorporated in ceiling construction may be erected with soft, annealed steel conforming to \-ASTM A 853-\.

2.4.7.1 Clips

Clips used in lieu of tie wire for securing the furring channels to the runner channels in ceiling construction shall be made from strip not less than 3 mm thick or shall be hairpin clip, formed of wire not less than 0.4 mm nominal diameter. Other clips and rings or fastenings of similar materials shall be equivalent in holding power to that provided by tie wire for the specific application.

2.5 ACOUSTIC INSULATION

2.5.1 Blanket Insulation

Acoustic insulation placed between the steel studs shall be batt or blanket type fiberglass conforming to ASTM C 665, Type I, unfaced.

PART 3 EXECUTION

3.1 INTERIOR WALL FRAMING

Steel framing and furring members shall be installed in accordance with \-ASTM C 754-\. Members shall be in alignment with spacings not to exceed the maximum spacings indicated on drawings. Runners shall be aligned accurately at the floor and ceiling and securely anchored.

3.1.1 Wall Openings

[AM#2] The framing system shall provide for the installation and anchorage of the required subframes or finish frames for wall openings at doors, pass-through openings, and access panels. Partitions abutting continuous suspended ceilings shall be strengthened for rigidity at rough openings of more than 750 mm wide. Studs at openings shall be 0.912 mm thick (20 gauge) minimum bare metal thickness and spot grouted at jamb anchor inserts. Double studs shall be fastened together with screws and secured to floor and overhead runners. Two studs (18 gage) placed back-to-back shall be used for framing ~~solid-core doors, doors over 900 mm wide and extra-heavy doors such as X-ray room doors~~all jambs of doors and windows. All door frames shall be spot grouted at all jamb anchor clips, except all sound rated door frames shall be completely filled with grout and fully sealed/caulked on both sides of the frame for the entire perimeter of the door.

3.1.2 Wall Control Joints

Control joints for expansion and contraction shall be constructed with double studs installed 13 mm apart in interior walls or wall furrings. Control joints shall be as located on the drawings or, if not indicated on the drawings, joint spacing shall not exceed 6 m. Ceiling-height door frames may be used as vertical control joints. Door frames of less than ceiling height may be used as control joints only if standard control joints extend to ceiling from both corners of top of door frame. Control joints between studs shall be filled with firesafing insulation.

3.2 SUSPENDED CEILING FRAMING

Suspended ceiling system framing shall be installed in accordance with \-ASTM C 754-\.

3.2.1 Hangers

Hangers shall be spaced not more than 1200 mm along runner channels and 900 mm in the other direction or 1050 mm in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other work. Hangers at ends of runner channels shall be located not more than 150 mm from wall. Hanger wire shall be looped around bottom chord of open-web steel joists, structural steel members, or center I-beam clamps with three full turns around itself. Sags or twists which develop in the suspended system shall be adjusted. Damaged or faulty parts shall be replaced.

3.2.2 Main Runners

Main runner channels shall be installed in accordance with \-ASTM C 754-\. Hanger wires shall be double strand saddle-tied to runner channels and the ends of hanger wire shall be twisted three times around itself. Main runners shall be located to within 150 mm of the paralleling wall to support the ends of cross furring. Main runners shall not come in contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped 300 mm with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around the channels.

3.2.3 Furring Channels

Furring channels shall be spaced in accordance with \-ASTM C 754-\. Furring channels shall be secured to the runner channels and to structural supports at each crossing with tie wire, hairpin clips, or equivalent fastenings. Furring channels shall be located within 50 mm of parallel walls and beams, and shall be cut 13 mm short of abutting walls.

3.2.4 Ceiling Openings

| [AM#2] Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than 38 mm 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~~at all four (4) corners of openings. Intermediate structural members not a part of the structural system, shall be provided for attachment or suspension of support members.

3.2.5 Light Fixtures

Light fixtures shall not be supported directly from suspended ceiling runners. Hanger wires for recessed or surface mounted light fixtures shall be anchored to structure at four corners of light fixtures, and additional wires shall be provided at appropriate locations to carry the weight of light fixtures.

3.2.6 Control Joints

Control joints for expansion and contraction shall be located where indicated on drawings, and shall not exceed 230 square meters in area nor more than 15 m in either direction.

3.3 APPLICATION OF GYPSUM BOARD

| [AM#2] Gypsum board shall be installed in accordance with \-ASTM C 840-\ and as specified. Edges and ends of gypsum boards shall be cut to obtain neat fitting joints. End joints of adjoining boards shall be staggered, and shall be staggered on opposite sides of wall. Boards shall be applied with moderate contact without forcing in place. Holes for pipes, fixtures or other small openings shall be cut with a tool which will provide a neat fit. Screws shall be driven so that the heads are slightly below the plane of paper face. Fracturing the paper face or damaging the core shall be avoided. Trim shall be installed at external and internal angles formed by the intersecting gypsum board surfaces with other surfaces. Corner beads shall be installed to vertical and horizontal corners in accordance with manufacturer's published instructions. Single layers of gypsum board shall be installed vertically on the studs.

3.3.1 Two-Ply Gypsum Board

Second layer of gypsum board shall be applied perpendicular to first layer with joints staggered and secured with mechanical fasteners and adhesive. The use of adhesive shall be in accordance with \-ASTM C 840-\.

3.3.2 Backing Board

Gypsum board 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 TAPING AND FINISHING

Gypsum board taping and finishing shall be performed in accordance with \-ASTM C 840-\. Boards shall be kept free of dirt, oil and other foreign matter that could cause a lack of bond. Screw heads, dents, gouges, and cut-outs shall be filled with joint compound and sanded. Accessories at exposed joints, edges, corners, openings, and similar locations shall be taped, floated with joint compound, and sanded to produce surfaces ready for gypsum board finishes.

Provide texture coating to all surfaces required to be painted. Texture coating mixture shall consist of four gallons of joint compound, one gallon latex wall primer or sealer, and water. Adjust as required to achieve light orange peel texture.

3.5 *FIRE-RESISTANT ASSEMBLIES*\

Gypsum wallboard construction for fire-rated assemblies shall be in accordance with \-UL-05-\, \-FM P8016-\ or \-GA 600-\ for the design number indicated on drawings.

3.6 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum board smooth, uniform in appearance, and ready to receive finish as specified.

3.7 IDENTIFICATION OF FIRE & SMOKE RATED GYPSUM WALL ASSEMBLIES

Contractor shall provide lettering on gypsum board for those walls that are rated. Lettering shall be located no more than 150 mm above finished ceiling for the length of wall that applies. Both sides of the rated wall shall be identified and marked BEFORE ceiling is installed. Lettering shall be at least 100 mm in height. Hand written identification shall not be permitted.

3.8 INSTALLATION OF ACOUSTIC INSULATION

Acoustic Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. Acoustical insulation the installed thickness shall be not less than 75 mm. Acoustic insulation shall be installed with not less than six staples per piece. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

3.9 [AM#2] ACCESS PANELS

Install access panels in gypsum board ceilings in accordance with Specification Section 05500. Acces panels shall be provided in ceilings for access to all valves, switches, water hammer arrestors, etc.

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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-\	(1994) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
\-ASTM C 636-\	(1992) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
\-ASTM E 119-\	(1995a) Fire Tests of Building Construction and Materials
\-ASTM E 1264-\	(1990) Standard Classification for Acoustical Ceiling Products
\-ASTM E 1414-\	(1991a) Standard Test for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.

UNDERWRITERS LABORATORIES (UL)

\-UL-05-\	(1995; Supple) Fire Resistance Directory

1.2 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units mechanically mounted on a ceiling suspension system. The unit size, texture, finish, and color shall be as specified. The location and extent of acoustical treatment shall be as shown on the drawings.

1.3 SUBMITTALS

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

SD-01 Data\

Acoustical Ceiling System\; *FIO*\.

Manufacturer's descriptive data and installation instructions.

SD-04 Drawings\

Acoustical Ceiling System\; *FIO*\.

Drawings shall show suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

SD-13 Certificates\

Fire Resistive Ceilings\; *FIO*\.

Ceiling Attenuation 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.

SD-14 Samples\

Acoustical Units\; *FIO*\.

Two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed to assure temperature and moisture conditions.

1.5 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 16 degrees C nor more than 27 degrees C and a relative humidity of not more than 70 percent shall be maintained before, during, and after installation of acoustical units.

1.6 SCHEDULING

Interior finish work such as plastering, concrete and ceramic tile 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. Prior to the installation of any ceiling, the Contractor, accompanied by the COR shall conduct an inspection of all above ceiling installation work to verify in

fact that the work is complete and is ready in all respects for installation of the finish ceiling work.

1.7 EXTRA MATERIALS

Extra acoustical ceiling tile of each color, pattern and type shall be furnished at the rate of 3 cases for each color, pattern and type. Extra materials shall be from the same lot as those installed. Spare stock is not acceptable. Materials shall be in manufacturer's original un-opened container with brand name, type and lot number clearly marked. Stock shall be inventoried and turned over to the COR at the time of pre-final inspection.

PART 2 PRODUCTS

2.1 *ACOUSTICAL UNITS*\

Acoustical units shall conform to \-ASTM E 1264-\, Class A, and the following requirements:

2.1.1 ACT-1; Units for Exposed-Grid System

Type: IV.
NRC: 0.70.
Pattern: ei.
Nominal size: 600 by 600 mm by 19 mm thickness.
Edge detail: Beveled tegular for 23 mm grid face.
Finish: Factory-applied standard finish.
LR: 0.80.
CAC: Minimum 35.

2.1.2 ACT-2; Units for Exposed-Grid System

Type: IV.
NRC: 0.10.
Pattern: e.
Nominal size: 600 by 600 mm by 19 mm thickness.
Edge detail: Trimmed and butt for 23 mm grid.
Finish: Factory-applied vinyl membrane finish.
LR: 0.83.
CAC: Minimum 40.

2.2 SUSPENSION SYSTEM

| [AM#2] Suspension system shall be standard exposed-grid standard width flange, and shall conform to \-ASTM C 635-\ for intermediate-duty systems. Surfaces exposed to view shall be aluminum or galvanized steel with a factory-applied white baked-enamel finish. Wall molding shall have a
| flange of not less than 23 mm and shall be provided with outside and inside
| corner caps at the corners. 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 1330 N ultimate vertical load without failure of supporting material or attachment.

2.4 FINISHES

Acoustical units and suspension system members shall have manufacturer's standard textures, patterns and finishes as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

2.5 COLORS AND PATTERNS

Colors and patterns for acoustical units and suspension system components shall be as specified on drawings.

2.6 *CEILING ATTENUATION CLASS AND TEST*\

Ceiling attenuation class (CAC) range of acoustical units, when required, shall be determined in accordance with \-ASTM E 1414-\. Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that the ceiling will be installed on the project. System shall be tested with all acoustical units installed.

PART 3 EXECUTION

3.1 INSTALLATION

Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb.

3.1.1 Suspension System

Suspension system shall be installed in accordance with \-ASTM C 636-\ and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

3.1.1.1 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Wall molding shall be provided where ceilings abut vertical surfaces. Wall molding shall be secured not more than 75 mm from ends of each length and not more than 400 mm on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if units weigh less than 5 kg per square m or if required for fire resistance rating. All ceilings in vestibules shall be held in place with manufacturer's standard hold down clips.

3.1.4 Color Coding Scheme for Locating Hidden Utility Components

| [AM#2] The color coding scheme is specified in Section 15405 - PLUMBING, HOSPITAL under Part 3 Execution. All cable trays, fire alarm pull boxes, VAV units and HVAC balancing dampers shall be included in the color coding scheme as approved by the Contracting Officer's Representative.

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.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 09650

RESILIENT FLOORING

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM D 4078-\	(1992) Water Emulsion Floor Polish
\-ASTM F 1066-\	(1987) Vinyl Composition Floor Tile
\-ASTM F 1303-\	(1990) Sheet Vinyl Floor Covering with Backing

FEDERAL SPECIFICATIONS (FS)

\-FS SS-T-312-\	(Rev B; Int Am 1; Notice 1) Tile, Floor: Asphalt, Rubber, Vinyl Vinyl-Asbestos
\-FS SS-W-40-\	(Rev A; Int Am1; Notice 1) Wall Base: Rubber and Vinyl Plastic

1.2 SUBMITTALS

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

SD-01 Data\

Resilient Flooring and Accessories\; *FIO*\.

Manufacturer's descriptive data and installation instructions. Cleaning and maintenance instructions shall be included.

SD-08 Statements\

Qualifications\; *FIO*\.

Copies of statements showing qualifications of installing firm and its installers and conform to the requirements specified.

SD-09 Reports\

Resilient Flooring and Accessories\; *FIO*\.

Copies of test reports showing that representative product samples of the flooring proposed for use have been tested by an independent testing laboratory within the past year and conform to the requirements specified.

Moisture Test\; *FIO*\.

Copies of testing laboratory report certifying that the moisture content of the concrete subfloor has been tested and is in compliance with the finish flooring manufacturer' requirements. With the report, also include a copy of the finish flooring manufacturer's moisture content requirements.

SD-14 Samples\

Resilient Flooring and Accessories\; *GA*\.

Three samples of each indicated color and type of flooring and base. Sample size shall be minimum 75 mm by 125 mm.

1.3 QUALIFICATIONS

Sheet vinyl flooring and integral coved base work shall be performed by a company which specializes in seamless installations and whose installers are both factory certified and also have a minimum of 3 years experience with the type of installations specified. Certification documents shall be submitted to the Contracting Officer's Representative a minimum of 30 days prior to installation of the flooring.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers, shall be stored in a clean dry area with temperature maintained above 21 degrees C for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations.

1.5 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 21 degrees C for 2 days before application, during application and 2 days after application. A minimum temperature of 13 degrees C shall be maintained thereafter.

1.6 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.7 EXTRA MATERIALS

Extra flooring material of each color and pattern shall be furnished at the rate of 10 tiles for each 1000 tiles and one m square for each 92 m square of sheet flooring installed. Round the required amount of materials to a whole box or boxes and furnish in unopened boxes as

received from the manufacturer. Extra materials shall be from the same lot as those installed. Extra base material composed of 6 m of each color shall be furnished. Extra materials shall be inventoried and turned over to the Contracting Officer's Representative at the time of pre-final inspection.

PART 2 - PRODUCTS

2.1 VINYL-COMPOSITION TILE

Vinyl-composition tile shall conform to \-ASTM F 1066-\, Class 2,(through pattern tile), Composition 1, asbestos-free, and shall be 300 mm square and 3.0 mm thick. Tile shall have the color and pattern uniformly distributed throughout the thickness of the tile. Flooring in any one continuous area shall be from the same lot and shall have the same shade and pattern. Color and pattern shall be as specified on drawings.

2.2 SHEET VINYL FLOORING

Sheet vinyl flooring shall be composed of a homogeneous, nonlayered solid vinyl composition. Color and pattern shall be dispensed uniformly throughout the thickness of the wearlayer. Sheet vinyl flooring shall be not less than 1.8 m wide. Color and pattern shall be as specified on drawings.

2.2.1 Sheet Vinyl Flooring (with backing)

Sheet vinyl flooring with backing shall conform to \-ASTM F 1303-\, Type II, Grade 1 minimum wear layer thickness 1.27 mm and minimum overall thickness 2.03 mm. Vinyl granules shall extend through the thickness of the wear layer.

2.2.2 Rod for Heat-Welding Seams

Product of floor covering manufacturer in color to match color of sheet vinyl floor covering.

2.2.3 Cove Filler Strip

Manufacturer's standard vinyl, rubber or wood quarter round shaped strip to provide support for sheet floor covering coved up wall at base; 19 mm radius minimum.

2.2.4 Cap Strip

Manufacturer's standard extruded vinyl or aluminun cap shape for top termination of sheet floor covering coved base. Color to match sheet flooring material or be clear anodized polished finish.

2.3 RESILIENT BASE

Base shall be rubber or vinyl type, coved. Base shall be 100 150 mm high and a minimum 3 mm thick. Preformed outside corners shall be furnished. Job formed inside corners shall be used. Color shall be as specified on drawings.

2.4 EDGE STRIP

Edge strip shall be vinyl, 25 mm wide, and of thickness to match the flooring. Color shall match wall base color unless otherwise specified on drawings.

2.5 ADHESIVE

Adhesive for flooring and wall base shall be as recommended by the flooring manufacturer.

2.6 POLISH

| [AM#2] Polish shall conform to \-ASTM D 4078-\. The type of polish/wax to
| use on the floor shall be compatible with the MEDEC facility cleaning
| crew.

PART 3 - EXECUTION

3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government.

3.2 SURFACE PREPARATION

Flooring shall be in a true, level plane, except where indicated as sloped. Before any work under this section is begun, all defects such as rough or scaling concrete, low spots, high spots, and uneven surfaces shall have been corrected, and all damaged portions of concrete slabs shall have been repaired as recommended by the flooring manufacturer. Concrete curing compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs.

3.3 \+MOISTURE TEST+\

The suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content shall be determined by a moisture test as recommended by the flooring manufacturer. The Contractor shall provide the Contracting Officer's Representative with a copy of the manufacturer's moisture content requirement and a testing laboratory report certifying that the moisture content of the concrete subfloor has been tested and is in compliance with the manufacturer's requirements.

3.4 INSTALLATION OF VINYL-COMPOSITION TILE

Tile flooring shall be installed with adhesive in accordance with the manufacturer's installation instructions. Tile lines and joints shall be kept square, symmetrical, tight, and even. Each floor shall be in a true, level plane, except where indicated as sloped. Edge width shall vary as necessary to maintain full-size tiles in the field, but no edge tile shall be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Edge tile shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied.

3.5 INSTALLATION OF SHEET VINYL FLOORING AND INTEGRAL COVED BASE

Sheet vinyl flooring shall be installed with adhesive in accordance with the manufacturer's installation instructions. Flooring shall be fitted to the room by hand cutting, straight scribing, or pattern scribing as necessary to suit job conditions. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Seams shall be cut by overlapping or underscribing as recommended by the manufacturer. Seams and edges of sheet vinyl flooring shall be heat welded as recommended by the manufacturer. Flooring shall be installed with an integral coved base. All inside and outside corners of the integral cove base shall be heat welded as recommended by the manufacturer. Integral coved base shall be formed by extending the flooring material 100 mm onto the wall surface. Cove shall be supported by a coved filler strip having a minimum radius of 19 mm. Coved base shall be installed with adhesive in accordance with the manufacturer's instructions. A metal or vinyl cap strip shall be provided at the top of the base.

3.6 INSTALLATION OF EDGE STRIPS

Edge strips shall be secured with adhesive as recommended by the manufacturer. Edge strips shall be provided at locations where flooring termination is higher than the adjacent finished flooring, except at doorways where thresholds are provided.

3.7 INSTALLATION OF RESILIENT BASE

Wall base shall be installed with adhesive in accordance with the manufacturer's instructions. Base joints shall be tight and base shall be even with adjacent resilient flooring.

3.8 CLEANING

Immediately upon completion of installation of tile in a room or an area, flooring and adjacent surfaces shall be cleaned to remove all surplus adhesive. No sooner than 5 days after installation, flooring shall be washed with a nonalkaline cleaning solution, rinsed thoroughly with clear cold water, and given two coats of polish. After each polish coat, floors shall be buffed to an even luster with an electric polishing machine.

3.9 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage. All flooring shall be broom and damp mop cleaned, dry and covered in its entirety with rosin sized sheeting weighing 195 to 293 g/sq. m (4 to 6 pounds per 100 square feet), free of wrinkles, flat and smooth and taped at all joints and perimeters. The contractor shall exercise due diligence to maintain the rosin sized sheeting free of rips and tears. When tears do occur, the damaged area of rosin sized sheathing shall be immediately removed and replaced with new rosin sized sheeting and retaped. Flooring which becomes damaged, loose, broken, or curled shall be removed and replaced.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

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.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

\-ACGIH-02-\	(1993) 1993-1994 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM D 3273-\	(1994) Resistance to Growth of Mold on the Surface of Interior Coating in an Environmental Chamber
\-ASTM D 3274-\	(1995) Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation
\-ASTM D 4214-\	(1989) Evaluating the Degree of Chalking of Exterior Paint Films
\-ASTM D 4258-\	(1983; R 1992) Surface Cleaning Concrete for Coating

COMMERCIAL ITEM DESCRIPTIONS (CID)

\-CID A-A-2247-\	(Basic) Paint, Latex (Semigloss, Interior)
\-CID A-A-2248-\	(Basic) Paint, Latex, (Flat, Interior)
\-CID A-A-2340-\	(Basic) Primer Coating (Latex, White, for Gypsum Wallboard)
\-CID A-A-2834-\	(Rev A) Urethane, Waterborne (Low VOC, Clear)

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-E-489-\	(Rev J) Enamel, Alkyd, Gloss, Low VOC Content
\-FS TT-E-2784-\	(Rev A; Am 1) Enamel (Acrylic-Emulsion, Exterior Gloss and Semigloss)
\-FS TT-P-19-\	(Rev D) Paint, Latex (Acrylic Emulsion, Exterior Wood and Masonry)
\-FS TT-P-38-\	(Rev E) Paint, Aluminum (Ready-Mixed)
\-FS TT-P-645-\	(Rev B) Primer, Paint, Zinc-Molybdate, Alkyd Type

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

\-SSPC Paint 5-\	(1995) Zinc Dust, Zinc Oxide and Phenolic Varnish Paint
\-SSPC Paint 18-\	(1991) Chlorinated Rubber Intermediate Coat Paint
\-SSPC Paint 25-\	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)
\-SSPC Paint 26-\	(1991) Slow Drying Linseed Oil Black Maintenance Primer (Without Lead and Chromate Pigments)&\
\-SSPC SP 1-\	(1982) Solvent Cleaning
\-SSPC SP 2-\	(1995) Hand Tool Cleaning
\-SSPC SP 3-\	(1995) Power Tool Cleaning
\-SSPC SP 7-\	(1994) Brush-Off Blast Cleaning

1.2 SUBMITTALS

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

SD-01 Data\

Paint\; *FIO*\.

The names, quantity represented, and intended use for the proprietary brands of materials proposed to be substituted for the specified materials regardless of quantities in states where VOC content limitations apply.

SD-06 Instructions\

Mixing and Thinning\; *FIO*\.

Application\; *FIO*\.

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings. Detailed application instructions for textured coatings shall be provided.

SD-09 Reports\

Paint\; *FIO*\.

A statement as to the quantity represented and the intended use, plus the following test report for batches in excess of 200 L:

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 liter, viscosity, fineness of grind, drying time, color, and gloss.

SD-13 Certificates\

Lead\; *FIO*\.

Mildewcide and Insecticide\; *FIO*\.

Volatile Organic Compound (VOC) Content\; *FIO*\.

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead by weight of the total nonvolatile. Certificate stating that paints proposed for use meet Federal VOC regulations and those of the local Air Pollution Control Districts having jurisdiction over the geographical area in which the project is located.

SD-14 Samples\

Paint\; *FIO*\.

While the material is at the site or source of supply, and at a time agreeable to the Contractor and the Contracting Officer, a 1 liter sample of each color and batch, except for quantities of 200 liters or less, shall be taken by random selection from the sealed containers by the Contractor in the presence of a representative of the Contracting Officer. The contents of the containers to be sampled shall be thoroughly mixed to ensure that the sample is representative. Samples shall be identified by

designated name, specification number, manufacturer name and address, batch number, project contract number, intended use, and quantity involved.

1.3 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 20 liters. Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 4 and 35 degrees C. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

1.4 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports furnished, samples will be retained by the Government for testing should the materials appear defective during or after application. In addition to any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 7 and 35 degrees C when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings. Water-thinned coatings shall be applied only when ambient temperature is between 10 and 32 degrees C. Epoxy coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer.

1.6 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.6.1 Worker Exposures

Exposure of workers to hazardous chemical substances shall not exceed limits as established by \-ACGIH-02-\, or as required by a more stringent applicable regulation.

1.6.2 Toxic Compounds

Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless approved by the Contracting Officer.

1.6.3 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material data safety sheets (MSDS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

1.6.4 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from preparation, painting and clean-up operations.

PART 2 PRODUCTS

2.1 *PAINT*\

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform to the respective specifications listed for use in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 200 liters or less, an approved first-line proprietary paint material with similar intended formulation, usage and color to that specified may be used. Additional requirements are as follows:

2.1.1 Colors and Tints

Colors shall be as selected from manufacturer's standard colors, as indicated. Manufacturer's standard color is for identification of color only. Tinting of epoxy paints shall be done by the manufacturer. Stains shall conform in shade to manufacturer's standard color. The color of the undercoats shall vary slightly from the color of the next coat.

2.1.2 *Mildewcide and Insecticide*\

Paint specified for all coats applied to fabrics and vapor barrier jackets over insulation shall contain a mildewcide that will not adversely affect the color, texture, or durability of the coating. The mildewcide shall be incorporated into the paint by the manufacturer and shall attain a surface disfigurement rating of 8 or greater when tested in accordance with \-ASTM D 3273-\ and evaluated in accordance with \-ASTM D 3274-\. Mercurial mildewcide shall not be used in interior paint. Insecticides shall not be used in paint.

2.1.3 *Lead*\

Paints containing lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal) shall not be used.

2.1.4 Chromium

Paints containing zinc chromate or strontium chromate pigments shall not be used.

2.1.5 *Volatile Organic Compound (VOC) Content*\

Paints shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority.

2.1.6 Very Low Odor Latex Paint

In addition to meeting requirements of CID A-A-2247 (semi-gloss) and CID A-A-2246 (flat) of referenced standards, latex paint indicated to be "very low odor" shall be latex paints with zero VOC or low VOC (1.0 VOC or less) and having no objectionable odor equal to Glidden Spred 2000, No. 7800 Series; Sherwin-Williams HealthSpec, or Benjamin Moore & Co. Pristine Line. Use of manufacturer's proprietary product names to designate colors, items, or materials is to establish level of quality and is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primmed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.2.1 Concrete, Stucco and Masonry Surfaces

Concrete, stucco and masonry surfaces shall be allowed to dry at least 30 days before painting, except concrete slab on grade which shall be allowed to cure 90 days before painting. Surfaces shall be cleaned in accordance with \-ASTM D 4258-\. Glaze, efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting. Surfaces to receive or epoxy coatings shall be acid-etched or mechanically abraded as specified by the coating manufacturer, rinsed with water, allowed to dry, and treated with the

manufacturer's recommended conditioner prior to application of the first coat.

3.2.2 Ferrous Surfaces

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned or detergent-washed in accordance with \-SSPC SP 1-\. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to \-SSPC SP 2-\, power tools according to \-SSPC SP 3-\ or by sandblasting according to \-SSPC SP 7-\. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

3.2.3 Nonferrous Metallic Surfaces

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned or detergent-washed in accordance with \-SSPC SP 1-\.

3.2.4 Gypsum Board Surfaces

Gypsum board surfaces shall be dry and shall have all loose dirt and dust removed by brushing with a soft brush, rubbing with a cloth, or vacuum-cleaning prior to application of the first-coat material. A damp cloth or sponge may be used if paint will be water-based.

3.2.5 Mastic-Type Surfaces

Mastic-type surfaces shall be prepared by removing foreign material.

3.2.6 Wood Surfaces

Wood surfaces shall be cleaned of foreign matter. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter, unless otherwise authorized. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints. Small, dry seasoned knots shall be scraped, cleaned, and given a thin coat of commercial knot sealer, before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or, if it is still soft, removed with mineral spirits or turpentine, and the resinous area shall be thinly coated with knot sealer. Finishing nails shall be set, and all holes and surface imperfections shall be primed. After priming, holes and imperfections in finish surfaces shall be filled with putty or plastic wood filler, colored to match the finish coat if natural finish is required, allowed to dry, and sanded smooth. Putty or wood filler shall be compatible with subsequent coatings.

3.2.6.1 Interior Wood Stain

Interior wood surfaces to receive stain shall be sanded. Oak and other open-grain wood to receive stain shall be given a coat of wood filler not less than 8 hours before the application of stain; excess filler shall be removed and the surface sanded smooth.

3.2.7 Previously Painted Surfaces

Previously painted surfaces damaged during construction shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas. Edges of chipped paint shall be feather edged and sanded smooth. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting. Chalk shall be removed so that when tested in accordance with \-ASTM D 4214-\, the chalk resistance rating is no less than 8. New, proposed coatings shall be compatible with existing coatings. If existing surfaces are glossy, the gloss shall be reduced.

3.3 *MIXING AND THINNING*\

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 0.125 L of suitable thinner per liter. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.3.1 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.4 *APPLICATION*\

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

3.4.1 Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by \-ACGIH-02-\, or as required by a more stringent applicable regulation.

Interior work zones having a volume of 280 cubic meters or less shall be ventilated at a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried.

3.4.2 Respirators

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

3.4.3 First Coat

The first coat on plaster, gypsum wallboard, and other surfaces shall include repeated touching up of suction spots or overall application of primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application. The first coat on both faces of wood doors shall be applied at essentially the same time. Glazed doors and sashes shall be given the specified coating system within 3 weeks of the time they are glazed, but not before the glazing material has set; paint shall overlay glass about 1.78 mm all around. Each varnish coat shall be sanded lightly prior to application of subsequent coats.

3.4.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

3.4.5 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

3.5 IDENTIFICATION OF FIRE AND SMOKE RATED WALL ASSEMBLIES

Contractor shall provide painted identification band and lettering on those walls that are rated. Lettering and band shall be located no more than 6" above finished ceiling for the length of wall that applies. Both sides of the rated wall shall be identified and marked BEFORE ceiling is installed. Band shall be a 4" high continuous red line. Lettering shall be at least 4" in height. Hand written identification shall not be permitted.

3.6 PIPE COLOR CODE MARKING

Pipes in exposed areas and in accessible pipe spaces shall be provided with color band and titles adjacent to all valves, except those provided at plumbing fixtures, at not more than 12 meter spacing on straight pipe runs, adjacent to change in direction, and on both sides where pipes pass through walls or floors. Color code marking shall be of the color listed in TABLE I and the size listed in TABLE II. The arrows shall be installed adjacent to each band to indicate the direction of flow in the pipe. The legends shall be printed in upper-case black letters as listed in TABLE I. Letter sizes shall be as listed in TABLE II. Marking shall be painted or applied using colored, pressure-sensitive adhesive markers of standard manufacture. Paint shall be as specified for insulated and uninsulated piping. All insulated pipe shall be marked "ASBESTOS FREE INSULATION" at same spacing and locations as indicated for piping.

TABLE I. COLOR CODES FOR MARKING PIPE

Material	Band	Letters and Arrow*	Legend
Cold water (potable)	Green	White	POTABLE WATER
Fire protection water	Red	White	FIRE PR. WATER
Hot water (domestic)	Green	White	H.W.
Hot water recirculating (domestic)	Green	White	H.W.R.
Low temp. water supply (heating)	Yellow	Black	L.T.W.S.
Low temp. water return (heating)	Yellow	Black	L.T.W.R.
Chilled water supply	Green	White	C.H.W.S.
Chilled water return	Green	White	C.H.W.R.
Chemical feed	Yellow	Black	CH. FEED
Natural gas	Blue	White	NAT. GAS

TABLE II. COLOR CODE MARKING SIZE

Outside Diameter of Pipe Covering (mm)	Width of Color Band (mm)	Arrow Length x Width (mm)	Size of Legend Letters and Numerals (mm)
Less than 38	200	200 x 57	13
38 to 60	200	200 x 57	19
60 to 150	300	200 x 57	31
200 to 225	600	300 x 110	63
Over 250	800	300 x 115	88

3.7 MISCELLANEOUS PAINTING

3.7.1 Lettering

Lettering shall be provided as scheduled on the drawings, shall be block Gothic type, and shall be black enamel. Samples shall be approved before application.

3.8 SURFACES TO BE PAINTED

Surfaces listed in the painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled.

3.9 SURFACES NOT TO BE PAINTED

Surfaces in the following areas are not to be painted: In addition surfaces of sprinkler heads, fire classification labels, and architectural precast concrete, hardware, fittings, and other factory finished items shall not be painted.

3.10 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.

3.11 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. Contractor options are indicated by ------or------ between optional systems or coats.

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EXTERIOR PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
Ferrous metal unless otherwise specified.	SSPC Paint 25	FS TT-E-489	FS TT-E-489
[AM#2] Galvanized metal.	~~FS TT-P-19~~SSPC-5	FS TT-E-2784 Type II semi-gloss	FS TT-E-2784 Type II semi-gloss
Aluminum aluminum-alloy, and other non-ferrous metal (non-galvanized)	FS TT-P-19	FS TT-E-2784 Type II semi-gloss	FS TT-E-2784 Type II semi-gloss

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INTERIOR PAINTING SCHEDULE

Surface	First Coat	Second Coat	Third Coat
gypsum board unless otherwise specified	CID A-A-2340	semi-gloss - very low odor CID A-A-2247	**CID A-A-2247
----------or----------			
semi-gloss, unless otherwise indicated		CID A-A-2248 flat - very low odor	**CID A-A-2248
	** Indicates third coat required only for Bid Option 7		
Gypsum board in locations indicated on finish schedule to receive epoxy coating.	FS TT-C-535 Type II	FS TT-C-535 Type II	**FS TT-C-535 Type II
	** Indicates third coat required only for Bid Option 7		
Metal in shower, and restrooms.	Ferrous metal: FS TT-P-645 ---------- Aluminum: FS TT-P-645 ---------- Galvanized surface: no primer	FS TT-E-2784 Type	FS TT-E-2784 Type
Ferrous metal unless otherwise specified.	FS TT-P-645	FS TT-E-2784 Type	FS TT-E-2784 Type
All Ferrous metal in crawl space or concealed damp spaces or in exposed areas having unpainted adjacent surfaces including: hangers, rods, conduit, clips, etc.	SSPC Paint 26	SSPC Paint 26	None

Ferrous metal factory-primed mechanical and electrical equipment.	Two coats of paint as recommended by the equipment manufacturer		None
[AM#2] Galvanized metal:	~~FS TT-P-19~~SSPC-5	Two coats of paint to match adjacent areas semi-gloss, except flat at exposed metal roof deck	
Wood: unless otherwise specified.	CID A-A-2340	----------or---------- semi-gloss - very low odor CID A-A-2247	None
semi-gloss unless otherwise indicated		----------or---------- CID A-A-2248 flat - very low odor	None
Wood: stain and varnish finishes	Commercially available stain	CID A-A-2834 In addition a fourth coat of CID A-A-2834	CID A-A-2834
Metal: Convector enclosures, electrical conduit runs, metallic tubing, uninsulated ducts and pipes, pipe hangers, louvers, grilles, and air outlets in areas having painted adjacent surfaces.	Aluminum and ferrous metal: FS TT-P-645	None	None
	Galvanized surface: FS TT-P-19	CID A-A-2247	CID A-A-2247
Facing of vapor barrier jackets of presized or adhesive finished cloth over insulation on pipes, ducts, and equipment	Two coats of paint to match adjacent areas.		None

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SECTION 09950

WALLCOVERING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM E 84-\	(1995a) Surface Burning Characteristics of Building Materials
\-ASTM F 793-\	(1993) Standard Classification of Wallcovering by Durability Characteristics

1.2 SUBMITTALS

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

SD-01 Data\

Wallcovering and Accessories\; *FIO*\.

Manufacturer's descriptive data, documentation stating physical characteristics, flame resistance, mildew and germicidal characteristics.

SD-06 Instructions\

Installation\; *FIO*\.

Preprinted installation instructions for wallcovering and accessories.

Maintenance\; *FIO*\.

Preprinted cleaning and maintenance instructions for wallcovering and accessories.

SD-13 Certificates\

Wallcovering\; *FIO*\.

Manufacturer's statement attesting that the product furnished meets or exceeds specification requirements. The statement must; be dated after the award of the contract, state Contractor's name and address , name the project and location, and list the requirements being certified.

Warranty\; *FIO*\

SD-14 Samples\

Wallcovering and Accessories\; *GA*\.

Three samples of each indicated type, pattern, and color of wallcovering. Samples of wall covering shall be minimum 125 by 175 mm and of sufficient size to show pattern repeat. Three samples of each indicated type corner guard and wainscot cap.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in manufacturers original unopened containers labeled with manufacturers name, pattern, texture, size and related information. Materials shall be stored in accordance with the manufacturer's instructions in a clean dry ventilated area with temperature maintained above 16 degrees C for two days prior to installation.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive wallcovering shall be maintained at a temperature above 16 degrees C for 7 days before, during, and 7 days after application.

1.5 *WARRANTY*\

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

1.6 EXTRA MATERIALS

Extra material from the same dye lot consisting of one roll of full-width wallcovering for each color and pattern 30 linear meters of wallcovering installed shall be provided for maintenance. Materials shall be in the manufacturer's original unopened containers with brand name, type and lot number clearly marked. Stock shall be inventoried and turned over to the Contracting Officer's Representative at time of pre-final inspection.

PART 2 PRODUCTS

2.1 WALLCOVERINGS

Wallcoverings shall be material designed specifically for the specified use. The wallcovering shall contain a non-mercury based mildewcide. The wallcovering shall be type made without the use of cadmium based stabilizers. Wallcovering shall have a Class A flame spread rating of 0-25 and smoke development rating of 0-50 when tested in accordance with \-ASTM E 84-\.

2.1.1 Vinyl Wallcovering Type

Vinyl wallcovering shall be a vinyl coated woven or nonwoven fabric with germicidal additives and shall conform to \-ASTM F 793-\, Category V Type II, (0.445 to 0.815 kg total weight per square meter and width of 1372 mm.

2.2 PRIMER AND ADHESIVE

Primer and adhesive shall be of a type recommended by the wallcovering manufacturer and shall contain a non-mercury based mildewcide. Adhesive shall be strippable type.

2.3 COLOR, TEXTURE, AND PATTERN

Color, texture, and pattern shall be as specified on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

Contractor shall inspect all areas and conditions under which wallcoverings are to be installed. Contractor shall notify Contracting Officer in writing of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

3.2 SURFACE PREPARATION

[AM#2] Wallcovering shall not be applied to surfaces that are rough, that contain stains that will bleed through the wallcovering, or that are otherwise unsuitable for proper installation. Cracks and holes shall be filled and rough spots shall be sanded smooth. Surfaces to receive wallcovering shall be thoroughly dry. Surface of walls to receive vinyl wall coverings shall be primed ~~as required by manufacturer's instructions to permit ultimate removal of wallcovering from the wall surface~~before application of wall covering. Primer shall be allowed to completely dry before adhesive application.

3.3 *INSTALLATION*\

3.3.1 Vinyl Wallcovering

Wallcovering shall be installed in accordance with the manufacturer's installation instructions. Glue and adhesive spillage shall be immediately removed from wallcovering face and seams with a remover recommended by the manufacturer.

3.4 CLEAN-UP

Upon completion of the work, wallcovering shall be left clean and free of dirt or soiling. Surplus materials, rubbish, and debris resulting from the wallcovering installation shall be removed and area shall be left clean.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 10260

WALL AND CORNER PROTECTION

PART 1 - GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

\-AA DAF-45-\	(1980) Designation System for Aluminum Finishes

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM B 221-\	(1995a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
\-ASTM D 256-\	(1993a) Determining the Pendulum Impact Resistance of Notched Specimens of Plastics
\-ASTM D 635-\	(1991) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
\-ASTM E 84-\	(1995) Surface Burning Characteristics of Building Materials

SOCIETY OF AMERICAN AUTOMOTIVE ENGINEERS (SAE)

\-SAE J1545-\	(1986) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Color Trim

1.2 SUBMITTALS

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

SD-01 Data\

Corner Guards\; *FIO*\.

Wall Guards (Bumper Guards)\; *FIO*\.

Manufacturer's descriptive data, catalog cuts, installation instructions, and recommended cleaning instructions.

SD-04 Drawings\

Corner Guards\; *FIO*\.

Wall Guards (Bumper Guards)\; *FIO*\.

Drawings indicating locations and typical elevations of each type of item. Drawings shall show vertical and horizontal dimensions, full size sections, thickness of materials, and fastening details.

SD-13 Certificates\

Corner Guards\; *FIO*\.

Wall Guards (Bumper Guards)\; *FIO*\.

Statements attesting that the items comply with specified fire and safety code requirements.

Warranty\; *FIO*\

SD-14 Samples\

Finish\; *GA*\.

Manufacturer's standard samples indicating color and texture of materials.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Materials shall be kept dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 21 degrees C for at least 48 hours prior to installation.

1.4 *WARRANTY*\

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

PART 2 - PRODUCTS

2.1 GENERAL

To the maximum extent possible, corner guards and wall guards (bumper guards) shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

2.1.1 Resilient Material

Resilient material shall consist of high impact resistant extruded acrylic vinyl and shall conform to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance shall be 960.8 N.m/m when tested in accordance with \-ASTM D 256-\, (Izod impact, notched).

2.1.1.2 Fire Rating

Fire rating shall be Class 1 when tested in accordance with \-ASTM E 84-\, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with \-ASTM D 635-\. Material shall be labeled and tested by an approved nationally known testing laboratory.

2.1.1.3 Integral Color

Colored components shall have integral color and shall be matched in accordance with \-SAE J1545-\ to within plus or minus 1.0 on the CIE-LCH scales.

2.2 *CORNER GUARDS*\

2.2.1 Resilient Corner Guards

Corner guard units shall be surface mounted type, radius formed to profile shown. Corner guards shall extend from floor to ceiling. Mounting hardware, cushions, and base plates shall be furnished. Assembly shall consist of a snap-on corner guard formed from high impact resistant resilient material, minimum 2.0 mm thick, mounted on a continuous aluminum retainer. Extruded aluminum retainer shall conform to \-ASTM B 221-\, alloy 6063, temper T5 or T6. Factory fabricated end closure caps shall be furnished for top and bottom of surface mounted corner guards. Insulating materials that are an integral part of the corner guard system shall be provided by the manufacturer of the corner guard system.

2.2.2 Clear Plastic Corner Guards

Clear polycarbonate sheet plastic corner guards, 75 mm by 75 mm by 3 mm thickness, full height base to ceiling. Abrasion-resistant, clear, transparent polycarbonate plastic sheet with an impact-resistance rating of 864 J/m of width when tested according to ASTM D 256, Test Method A.

2.3 *WALL GUARDS (BUMPER GUARDS)*\

2.3.1 Wall Guards

Wall guards shall be provided with prefabricated end closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories standard with the manufacturer. Extruded aluminum retainers shall conform to \-ASTM B 221-\, alloy 6063, temper T5 or T6. End caps and corners shall be field adjustable to assure close alignment with handrails and wall guards. Wall guards shall be profile as shown.

2.3.1.1 Wall Guards

Wall guards shall consist of snap-on covers of high impact resistant resilient material, minimum 2.0 mm thick, mounted over 50 mmwide aluminum,

minimum 1.6 mm thick retainer, anchored to wall at maximum 600 mm on center.

2.4 FASTENERS AND ANCHORS

Fasteners and anchors shall be provided for each specific installation.

2.5 *FINISH*\

2.5.1 Aluminum Finish

Finish for aluminum shall be in accordance with \-AA DAF-45-\. Exposed aluminum shall be designation AA-C22A31 chemically etched medium matte, with clear anodic coating class II architectural coating 0.010 mm thick. Concealed aluminum shall be mill finish.

2.5.2 Resilient Material Finish

Finish for resilient material shall be embossed stipple texture with colors in accordance with \-SAE J1545-\.

2.6 ADHESIVES

Adhesive for resilient material shall be in accordance with manufacturers recommendations.

2.7 COLOR

Color shall be as specified on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

3.1.1 Corner Guards and Wall Guards (Bumper Guards)

Material shall be mounted at location indicated in accordance with manufacturer's recommendations.

| [AM#2] 3.1.2 | Provide backing for attachment of corner guards and wall guards with wall reinforcement as shown on Sequence #080, Detail 12. |

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 10800

TOILET ACCESSORIES

PART 1 GENERAL

The following schedule contains a listing of the equipment items that are identified by a Joint Schedule Number (JSN). The listing contains the JSN, nomenclature, Logistical responsibility, and specification reference. The requirements for individual items of equipment are contained in the appropriate portion of these specifications as indicated in this schedule.

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
\-CID A-A-2398-\	(Rev B) Curtain, Shower and Window (Metric - SI)

FEDERAL SPECIFICATIONS (FS)

\-FS DD-M-411-\	(Rev C) Mirrors, Glass
\-FS WW-P-541/GEN-\	(Rev E; Am 1) Plumbing Fixtures
\-FS WW-P-541/8-\	(Rev B; Am 1) Plumbing Fixtures (Accessories, Land Use)

1.2 LOGISTICAL CLASSIFICATION

Methods of procurement are defined as follows:

a. Category A: Contractor Furnished and Contractor Installed (CF/CI).

b. Category B: Government Furnished and Contractor Installed (GF/CI).

c. Category C: Government Furnished and Government Installed (GF/GI).

d. Category D: Other (leased or rented equipment or that obtained under special conditions. Funds will be determined by the using service.)

e. Category E: Government Furnished and Contractor Installed (GF/CI). (Procurement to be delayed until the latest date feasible that will not interfere with project completion. This will provide the latest Model of equipment at the time it is needed.)

f. Category F: Government Furnished and Government Installed (GF/GI). Procurement to be delayed until the latest date feasible that will not interfere with project completion. This will provide the latest model of equipment at the time it is needed. Equipment designated Logistical Category "B", "C", "E", and "F" will be Government provided. For equipment installed by the Government, the Contractor shall make preparations for installation, as indicated.

1.3 SUBMITTALS

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

SD-01 Data\

Finishes\; *FIO*\. *Accessory Items*\; *FIO*\.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, and operation instructions.

SD-14 Samples\

Finishes\; *GA*\. *Accessory Items*\; *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.

SD-19 Operation and Maintenance Manuals\

Maintenance Instructions\; *FIO*\.

Four complete copies of maintenance instructions listing routine maintenance procedures and possible breakdowns and repairs. Instructions shall include simplified wiring and control diagrams and other information necessary for unit maintenance.

1.4 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area protected from construction damage and vandalism.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated in accordance with paragraph SCHEDULE.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall tamperproof design and shall be finished to match the accessory.

2.1.2 Finishes

Finishes on metal shall be provided as follows:

Metal	Stainless steel
Finish	No. 4 satin finish

2.2 LOGCAT "A" (CF/CI) ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

2.2.1 JSN A5030 Shower Seat, Stainless Steel, Corner

Corner shower seat shall be constucted entirely of Type 304 stainless steel with satin finish. Shower seat shall be 1.6 mm, one piece construction with 25 mm channel formed return edge and have no sharp corners. Back corner of shower seat shall be formed on a 45 deg angel, in order to allow installation into a corner of the shower. Shower seat shall be held in upright position by retaining clip. The shower seat shall have a piano hinge along the edge of the anchoring side.

Similar to Bobrick Model B-508, or approved equal.

2.2.2 JSN A5110 Grab Bar (GB)

Grab bar shall be constructed of Type 304 stainless steel with satin finish. It shall have wall thickness of 1.2 mm and outside diameter of 38 mm. Clearance between the grab bar and wall shall be 38 mm. Flanges shall be 3.2 mm stainless steel, 76 mm diameter, and each shall have four stainless steel set screws. Ends of grab bar shall pass through flanges and be heliarc welded to form one structural unit. Concealed mounting plates shall be 2.3 mm stainless steel with three slotted screw holes. Grab bar shall comply with ADA Accessibility Guidelines for structural strength. Grab bar shall be form and length as indicated.

Similar to Bobrick Washroom Equipment, Inc. Model B-5637 or approved equal.

2.2.3 JSN A5110A Grab Bar (GB)

Grab bar shall conform to \-FS WW-P-541/GEN-\ and \-FS WW-P-541/8-\, Type IV, Class 2, 32 mm OD stainless steel. Grab bar shall be form and length as indicated. Concealed mounting flange shall have set screw mounting holes concealed on the lip of the flange. Grab bar shall have peened non-slip surface. Installed bars shall be capable of withstanding a 224 kg vertical load throughout.

Similar to Bobrick Washroom Equipment, Inc. Model B-5637 or approved equal.

2.2.4 JSN A5110B Grab Bar (GB)

Grab bar shall conform to \-FS WW-P-541/GEN-\ and \-FS WW-P-541/8-\, Type IV, Class 2, 132 mm OD stainless steel. Grab bar shall be form and length as indicated. Concealed mounting flange shall have set 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 224 kg vertical load throughout.

Similar to Bobrick Washroom Equipment, Inc. Model B-5617, or approved equal.

| 2.2.4.1 [AM#2] A5110, A110A, A5110B Grab Bars
|
| All of the above grab bars shall be attached to wall reinforcement per Detail 12, on Sequence #080.
|

2.2.5 Mirrors, Glass, General:

Unit shall consist of mirror with angled stainless steel frame with satin finish. Mirror shall be a minimum No. 1 Quality, 6.35 mm float/plate glass, electrolytically copper plated and guaranteed against silver spoilage for 15 years. Mirror shall be framed with a one piece, Type 304 stainless steel angle 19.05 mm x 19.05 mm with continuous integral stiffener on all sides. Corners of frame shall be heliarc welded, ground polished smooth. Edges of mirror shall be protected to prevent chipping by shock-absorbing, waterproof, nonabrasive padding. Unit shall be provided with a minimum 0.95 mm galvanized steel back with integral hanging brackets for mounting on a minimum 0.95 mm concealed wall hanger and secured with theft-resistant screws.

2.2.5.1 JSN A1066 Mirror, Glass (MG)

Tempered glass mirror with stainless steel channel frame. Glass mirror shall conform to \-FS DD-M-411-\.

Similar to Bobrick Washroom Equipment, Inc. Model B-145-1836 or approved equal.

2.2.5.2 JSN A1070 Mirror, Glass (MG)

Tempered glass mirror with stainless steel channel frame, 1219 mm length as indicated on drawings. Glass mirror shall conform to \-FS DD-M-411-\.

Similar to Bobrick Washroom Equipment, Inc. Model B-290-1836 or approved equal.

2.2.6 JSN A4995 Diaper Changing Station (DCS)

Diaper changing station shall be wall mounted and shall be fabricated of high impact plastic with no sharp edges. Unit fold down platform shall be concave to the child's shape, equipped with nylon and velcro safety straps and engineered to withstand a minimum static load of 152.320 kg. Unit shall have an integral dispenser for sanitary liners. Height 508 mm, Width 889 mm, Depth closed 102 mm / opened 508 mm. Static load holds up to 113 kg.

Similar to KOALA Corp., Horizontal Model or approved equal.

2.2.7 JSN A5080 Paper Towel Dispenser (PTD)

Paper towel dispenser shall conform to \-CID A-A-2380-\, Type I, shall be constructed of not less than 0.8 mm carbon steel and shall be surface

mounted. Locking mechanism shall be tumbler key lock. Shall have a capacity of not less than 400 singlefold paper towels.

Similar to Bobrick Washroom Equipment, Inc. Model B-263 or approved equal.

2.2.8 JSN A5090 Sanitary Napkin and Tampon Disposer (SND)

Sanitary napkin and tampon disposal shall be constructed of Type 304 stainless steel, disposable liner type and shall conform to \-FS WW-P-541/GEN-\ and \-FS WW-P-541/8-\, Type I, Class 1, Style P surface mounted. Fifty disposable liners of the type standard with the manufacturer shall be provided.

Similar to Bobrick Washroom Equipment, Inc. Model B-270 or approved equal.

2.2.9 JSN A5170 Shower Curtain Rods (SCR)

Shower curtain rods shall be Type 304 stainless steel 32 mm OD by 1.25 mm minimum thickness, straight to meet installation conditions. Length as indicated on drawings

Similar to Bobrick Washroom Equipment, Inc. Model B-207 x (Determined by Length Required) or approved equal.

2.2.10 JSN A5175 Soap and Grab Bar Combination

Recessed (SGR) Soap and grab bar combination shall conform to \-FS WW-P-541/GEN-\ or \FS WW-P-541/8-\, Type IV, Class 3, Type 304 stainless steel, except unit shall be recessed type.

Similar to Bobrick Washroom Equipment, Inc. Model B-6657 or approved equal.

2.2.11 JSN A5195 Toilet Tissue Dispenser (TTD)

Single-roll stainless steel toilet paper holder shall be constructed of type 304 stainless steel with satin finish. Unit shall accommodate one standard-core toilet paper roll up to 140 mm diameter (1800 sheets). Flanges shall be equipped with concealed, 1.6 mm stainless steel mounting brackets that are secured to conceal stainless steel wall plates with stainless steel locking set screws. Spindle shll be equipped with a heavy-duty internal spring.

Similar to Bobrick Washroom Equipment, Inc. Model B-6857 or approved equal.

2.2.12 JSN A5205 Towel Bar (TB)

Surface-mounted towel bar shall be Type 304 stainless steel with satin finish. Flanges and support arms shall be 0.8 mm and equipped with concealed, 1.6 mm mounting brackets that are secured to concealed, 1.6 mm wall plates with locking set screws. Towel bar shall be minimum 19 mm diameter.

Similar to Bobrick Washroom Equipment, Inc. Model B-6737 x 18 or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

| [AM#2] Toilet accessories shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions. Accessories shall be protected from damage from the time of installation
| until acceptance. Blocking for attachment of any and all wall mounted items
| in this specification shall be per Detail 12, Sequence #080.

3.2 SCHEDULE

Toilet accessories shall be identified by JSN and located as indicated on drawings and Room by Room Listing.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 10990

MISCELLANEOUS SPECIALTIES

PART 1 GENERAL

1.1 SUBMITTALS

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

SD-01 Data\

Finishes\; *FIO*\. *Specialty Items*\; *FIO*\.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, and operation instructions.

SD-14 Samples\

Finishes\; *GA*\. *Specialty 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.

SD-19 Operation and Maintenance Manuals

Maintenance Instructions\; *FIO*\

Four complete copies of maintenance instructions listing routine maintenance procedures and possible breakdowns and repairs. Instructions shall include simplified wiring and control diagrams and other information necessary for unit maintenance.

1.2 DELIVERY, STORAGE, AND HANDLING

Miscellaneous specialties shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area protected from construction damage and vandalism.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Miscellaneous specialties shall be provided where indicated in accordance with paragraph SCHEDULE.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the miscellaneous specialty to be mounted and shall be finished to match the miscellaneous specialty item.

2.1.2 Finishes

Finishes on metal shall be provided as follows:

Metal	Finish
Stainless steel	No. 4 satin finish

2.2 LOGCAT "A" (CF/CI) MISCELLANEOUS SPECIALTIES ITEMS

Miscellaneous specialties items shall conform to the requirements specified below.

2.2.1 JSN A5135 Rack, Mop/Broom, with Shelf

Surface mounted custodian utility shelf with hooks and mop and broom holders. Shall be constructed of Type 304 stainless steel with satin finish. Shelf shall be 203 mm deep with 19 mm return edges hemmed for safety. Mop and broom holders shall be mounted under shelf to prevent interference with stored materials. Unit shall be 1117 mm in length, with 5 spring loaded rubber cam holders and 6 type 304 stainless steel hooks.

Similar to Bobrick Model B-239 x 1117 mm or approved equal.

2.2.2 JSN A5145 Hook, Robe, 2 Prong

Surface mounted stainless steel double robe hook shall be constructed entirely of Type 304 stainless steel with satin finish. Flange shall be equipped with concealed mounting bracket that shall lock to a concealed wall plate with lock screw. Cap shall be stainless steel, welded post.

Similar to Bobrick Model B-6727 or approved equal.

2.2.3 JSN F3010 Board, Bulletin

Bulletin board with natural cork reinforced with sturdy back panel. Frame shall be of 32 mm satin finish aluminum. Unit shall be equipped with concealed hangers for wall fastening. Overall dimensions 1219 mm x 1219 mm.

Similar to Claridge Model 958A or approved equal.

2.2.4 JSN F3025 Board, Bulletin, Wood Framed

Bulletin board with natural cork surface laminated to backing sheet. Framed with natural finish hardwood. Unit shall be equipped with concealed hanger for wall fastening either horizontally or vertically. Overall dimensions 610 mm x 914 mm.

Similar to Claridge Model WC2436 or approved equal.

2.2.5 JSN F3045 Whiteboard, W/Tack board/Screen, Cabinet

The 1219 mm x 102 mm x 1219 mm two-door conference cabinet shall feature radius corners and s to be constructed of finished veneers and solids in medium oak. The writing surface shall be white LCS porcelain enamel for use with LCS liquid chalk markers (Dry Erase). The writing surface shall also accommodate magnetic aids. The inside of doors shall be No. 1691 Quarts Designer Fabric bulletin board, color as specified. The cabinet shall have a matte white pull-down projection screen

Similar to Claridge Model 509-4M, or approved equal.

2.2.6 JSN F3050 Whiteboard, WCP

Dry Erase Whiteboard, white LCS (Liquid Chalk System) surface shall be constructed of 0.85 mm steel with baked on porcelain. The LCS surface shall support magnetized aids. The frame shall be constructed of extruded aluminum, etched and anodized with satin finish for trim. The Whiteboard shall have a chalk trough with end closures and map rail. The Map Rail shall have one map hook furnished for every 1000 mm of map rail with a minimum of two furnished. Angle clip hangers shall be furnished for easy hanging. Unit shall be furnished with 51 mm angle clips for installation of unit to wall. Overall dimensions 914 mm x 1219 mm.

Similar to Claridge Model LCS2034R or approved equal.

2.2.7 JSN F3055 Whiteboard, WCP, 4 sliding Panels, w/Screen

LCS (Liquid Chalk System) surface shall be constructed of 0.85 mm steel with baked on porcelain. The LCS surface shall support magnetized aids. The frame shall be constructed of extruded aluminum, etched and anodized with satin finish for trim. The Whiteboard shall have a chalk trough with end closures. The Horizontal sliding panels shall be LCS (Dry Erase). The Borad shall consist of 3 sliding panels, 1 sliding projection screen and a fixed back panel. Witeboards shall be top- suspended and glide easily over the extended aluminum track n molded nylon rollers. Unit shall consist of 3 LCS sliding panels, 1 glass beaded projection screen and whiteboard back panel. Overall dimensions 1219 mm x 1829 mm.

Similar to Claridge Model HS46-4 or approved equal.

2.2.8 JSN F3230 Rack, Hat/Coat, Wall Mounted

Hat and coat rack with shelf and 5 coat hooks. Unit shall be of natural anodized aluminum finish; end caps and coat hooks of die-cast aluminum; bars of extruded aluminum and coat hanger of formed aluminum. Overall dimensions 813 mm x 297 mm x 159 mm.

Similar to Peter Pepper Model 2155AL or approved equal.

2.2.9 JSN F3235 Rack, Hat/Coat, Wall Mounted, Costumer

Hat and coat rack with shelf and 5 coat hooks. Unit shall be of natural anodized aluminum finish; end caps and coat hooks of die-cast aluminum; bars of extruded aluminum and coat hanger of formed aluminum. Overall dimensions 1524 mm x 337 mm x 305 mm.

Similar to Peter Pepper Model 2106 or approved equal.

2.2.10 JSN M0410 Screen, Projection 1778 mm x 1778 mm

Wall mounted projection screen with fiberglass matte, white viewing surface. Surface shall be washable, mildew and fire resistant. Unit shall have rigid one-piece Fabric-Lok steel rollers with positive locking spring mechanisms and mounted on an aluminum supporting bar. Unit shall be provided with 1 pair of wall mounting brackets.

Similar to Claridge Model MA7070 with Non-Adjusting Bracket 152 mm or approved equals.

2.2.11 JSN M1620 Holder, Chart, Patient, Wall Mounted

Unit shall consist of a solid white oak trim and a backboard (color to be determined). The overall dimensions shall be 419 mm wide by 299 mm high by 63 mm thick. The front shall be able to lift up for cleaning purposes. Normal pocket size shall be 51 mm deep. Unit shall easily accept storage of standard 292 mm wide files. All pieces of the unit shall be glued together to form an integral unit. Overall depth the unit shall be approximately 63 mm. Unit shall be wall mounted using fasteners as indicated for securing unit to wall surface and blocking system. All exposed edges of the backboard, pedestal supports, front clear acrylic panel, and shelf shall be provided with a uniform rounded edge. The unit shall be finished in accordance with SECTION \=09900=\ PAINTING, GENERAL. Coordinate with interior color palette.

Similar to Peter Pepper Model 13130 or approved equal.

2.2.12 JSN M8235 Mirror, Posture, Wall Mounted

Unit shall consist of mirror with angled stainless steel frame with satin finish. Mirror shall be a minimum No. 1 quality 6.35 mm float plate/glass electrolytically copper plated and guaranteed against silver spoilage for 15 years. Mirror shall be framed with a one piece, Type 304 stainless steel angle 19.05 mm x 19.05 mm with continuous integral stiffener on all sides. Corners of frame shall be heliarc welded, ground polished smooth. Edges of mirror shall be protected to prevent chipping by shock-absorbing, waterproof, nonabrasive padding. Unit shall be provided ith a minimum 0.85 mm galvanized steel back with integral hanging brackets for mounting on a minumum 0.85 mm concealed wall hanger and secured with theft-resistant screws.

The Wall Mounded Posture Mirror with frame shall be 1828 mm x 609 mm. The frame shall be one piece frame with 90 degree mitered corners. Mirrors shall be Glassless, lightweight, shatterproof, and distortion free.

Similar to Sammons Preston Fas-T Mirror Model 1612U, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

| [AM#2] Miscellaneous Specialties shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions. Miscellaneous specialties shall be protected from damage from

the time of installation until acceptance. Blocking for attachment of any and all wall mounted items in this specification shall be per Detail 12, Sequence #080.

3.2 SCHEDULE

Miscellaneous Specialties shall be identified by JSN and located as indicated on drawings and Room by Room Listing.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 11702

GENERAL REQUIREMENTS FOR MEDICAL EQUIPMENT

PART 1 GENERAL

The following schedule contains a listing of the equipment items that are identified by a Joint Schedule Number (JSN). The listing contains the JSN, nomenclature, Logistical responsibility, and specification reference. The requirements for individual items of equipment are contained in the appropriate portion of these specifications as indicated in this schedule.

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI 531.1-\	(1977)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM E 413-\	(1987, R1994) Classification for Rating Sound Insulation
\-ASTM E 24-\	(Discontinued 1968) Definitions of Terms Relating to Rheological Properties of Matter
\-ASTM E 90-\	(1997) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
\-ASTM E 596-\	(1996) Laboratory Measurement of the Noise Reduction of Sound-Isolating Enclosures
\-ASTM C423-\	(1990) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

AMERICAN WATER WORKS ASSOCIATION (AWWA)

\-AWWA C510-\	(1992) Double Check Valve Backflow-Prevention Assembly.
\-AWWA C511-\	(1992) Reduced-Pressure Principle Backflow.

CODE OF FEDERAL REGULATIONS (CFR)

\-21 CFR 701-\	Cosmetic Labeling Regulation for the Enforcement of the Federal Food, Drug and

Cosmetics Act and for Packaging and abeling act.

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

\-FCCCHR-USC-\ (1992) List of Approved Backflow Prevention Assemblies.

NATIONAL BUREAU OF STANDARDS

NATIONAL BUREAU OF STDS NAT'L VOLUNTARY LABORATORY ACCREDITATION PROGRAM

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

\-NEMA MG 1-\ (1993) Motors and Generators.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 70-\ (1993) National Electrical Code.

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

\-NFPA 101-\ (1994) Code for Safety to Life from Fire in Buildings and Structures.

NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP)

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

\-SMACNA SRM-\ (1991) Seismic Restraint Manual Guidelines for Mechanical Systems.

UNDERWRITERS LABORATORIES INC. (UL)

\-UL 544-\ (1993; Bul. 1993 and 1994) Medical and Dental Equipment.

\-UL 674-\ (1994) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations.

1.2 LOGISTICAL CLASSIFICATION

Methods of procurement are defined as follows:

a. Category A: Contractor Furnished and Contractor Installed (CF/CI).

b. Category B: Government Furnished and Contractor Installed (GF/CI).

c. Category C: Government Furnished and Government Installed (GF/GI).

d. Category D: Other (leased or rented equipment or that obtained under special conditions. Funds will be determined by the using service.)

e. Category E: Government Furnished and Contractor Installed (GF/CI). (Procurement to be delayed until the latest date feasible that will not interfere with project completion. This will provide the latest Model of equipment at the time it is needed.)

f. Category F: Government Furnished and Government Installed (GF/GI). Procurement to be delayed until the latest date feasible that will not interfere with project completion. This will provide the latest model of equipment at the time it is needed. Equipment designated Logistical Category "B", "C", "E", and "F" will be Government provided. For equipment installed by the Government, the Contractor shall make preparations for installation, as indicated.

1.3 SUBMITTALS

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

SD-01 Data\

Manufacturer's Catalog Data\; *GA*\

Contractor-furnished medical and dental equipment Submit within 60 days after award of contract, but before ordering equipment. Submit names and addresses of manufacturers, item's catalog numbers, trade names, literature, data sheets, diagrams, drawings, and other pertinent data for each referenced item to evaluate performance, dimensions, and appearance of the equipment and materials. Submit in triplicate copies of manufacturer's printed specifications and installation requirements.

Manufacturer's Standard Color Charts for Medical and dental equipment\; *GA*\

SD-04 Drawings\

Medical and dental equipment\; *GA*\

Composite Coordinated Drawings Submit for equipment items that interface with other pieces of equipment or construction. Indicate the following:

a. Coordination of equipment services

b. Coordination of pertinent details of construction.

Installation Drawings Submit three copies showing the following. Verify job conditions affecting the work, and obtain accurate measurements for incorporation into the installation drawings.

a. Installation layout

b. Details of construction and rough-in requirements.

SD-06, Instructions\

Training Plan\; *GA*\

Submit schedule for Field Training at least 30 working days prior to the date of the proposed training course. Identify date, time, and location for the training. Include the proposed curicula schedule and an outline of specific items to be covered in the training course.

SD-07 Schedules\

Contractor-furnished medical and dental equipment schedule\; *GA*\.

Schedule Requirements: Submit three copies of loose leaf binder with index of Contractor-furnished medical and dental equipment list.

SD-08, Statements\

Medical and dental equipment deviations\; *GA*\

Medical and dental equipment substitutions\; *GA*\

Backflow preventers Certificate of Full Approval\; *GA*\

Standards Deviations

Submit for approval a record of deviations from the following standards established for the specified product, before ordering equipment.

a. Size of equipment
b. Function of equipment
c. Standard and listed accessories
d. Equipment controls and performance of equipment
e. Construction of equipment.

Substitutions

Submit before ordering equipment.

a. Size: Layouts shall be based on the unit specified. If the size of a substituted unit differs from the item specified and is accepted, submit to the Contracting Officer for approval a revised layout, design calculations, drawings, and specifications for changes in the building to accommodate the substituted equipment.

b. Function: Additional functions and accessories of substituted equipment will not be considered as an improvement over the unit specified. If such functions are standard equipment of a substituted item but the function is not desired by the Government, then it shall be at the discretion of the Government to either have the Contractor completely remove that function from the unit, if the unit is otherwise acceptable, or allow the Contractor to retain that function on the unit under the following conditions:

(1) The function is fully operational and its performance complies with the terms and conditions of this specification, including product quality and warranty.

(2) The function shall in no way eliminate or modify those functions required by the Government on the specified unit. Refinement in control or accessibility of the substituted unit will be considered an improvement over the specified unit.

c. Appearance: Only the following aesthetic qualities of design will be considered an improvement:

(1) Uniformity of finish.

(2) Variety of finish selections.

(3) Compatibility with substituted item.

Certificate of Full Approval

Submit a Certificate of Full Approval from the Foundation of Cross-Connection Control and Hydraulic Research (FCCCHR), University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval will not be acceptable.

SD-09 Reports\

Factory Test Reports\; *GA*\

Factory inspection Submit three copies of the test reports required or specified and performed by an approved laboratory.

SD-13 Certificates\

Materials and equipment\; *GA*\

Before ordering, submit three copies of certificates attesting that materials and equipment meet the specified requirements.

Standards Compliance\; *GA*\

Submit one of the following as evidence of proof of conformance for materials or equipment specified to conform to the standards of organizations such as the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA), American Society of Mechanical Engineers (ASME), American Gas Association (AGA), Air-Conditioning and Refrigeration Institute (ARI), and Underwriters Laboratories, Inc. (UL).

a. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual sections.

b. In lieu of the label or listing, submit a certificate from an independent testing organization, which is competent to perform acceptable testing and is approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance

with the specified organization's test methods and that the item conforms to the specified organization's standard.

c. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, submit a certificate of compliance from the manufacturer for approval, identifying the manufacturer, product, and referenced standard and certification stating that the product conforms to the requirements of the project specification and the referenced standards listed.

SD-19 Operation and Maintenance Manuals\

Medical and dental equipment, Data Package\; *GA*\

Submit operation and maintenance data for each unit of equipment furnished for the project.

1.4 QUALITY ASSURANCE

1.4.1 Materials and Equipment

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of products which are of a similar material, design, and workmanship and are offered for sale on the commercial market through advertisements, manufacturer's catalogs, or sales brochures. The products shall have been in commercial or industrial use under similar circumstances and of similar size for 2 years prior to the bid opening.

1.4.2 Alternative Service Record

Products having less than a 2-year field service record will be acceptable if a certified record of the manufacturer's factory or laboratory tests demonstrating performance compliance is provided to the Contracting Officer.

1.4.3 Service Support

Equipment items shall be supported by service organizations located near the equipment installation, and able to service the equipment on a regular basis and respond immediately on emergency calls throughout the warranty period.

1.4.4 Manufacturer's Nameplate

Each piece of equipment shall have the manufacturer's name, capacities, including voltage and amperage rating if electrically powered on the nameplate, securely affixed in a conspicuous place. The name of only the distributing agent on the plate is not acceptable.

1.4.5 Factory Inspection

Arrange and perform all factory inspections required by the technical sections of the specification, unless otherwise specified. Report these inspections in the daily report to the Government inspector.

1.4.6 Product Qualifications

The products specified by the technical sections of the specification establish standards for each item.

1.4.7 Design Parameters

Equipment furnished shall meet each of the following parameters specified in the technical sections.

a. Size of equipment.

b. Function of equipment.

c. Standard and listed accessories.

d. Equipment controls and performance of equipment.

e. Construction of equipment.

1.5 PACKAGING, STORAGE AND PROTECTION

1.5.1 Packaging

Package each piece of equipment to ensure protection from damage during shipment and delivery. Legibly indicate on the exterior of each container or crate, the shipping address and a brief description of its contents. Outside of the container, fasten a waterproof envelope containing a packing list and complete instructions for uncrating and setting the equipment in place.

1.5.2 Storage and Protection

During storage and until completion and acceptance by the Contracting Officer, protect materials and equipment from damage. Before acceptance by the Contracting Officer, remove all protective coverings, thoroughly clean the inner and outer surfaces, and ensure that the equipment is free from defects.

PART 2 PRODUCTS

2.1 MATERIALS

Materials not specified otherwise shall be of the same quality used for the intended purpose in commercial practice. Equipment, materials, and articles incorporated in the work shall be new. Any deviations or substitutions shall be reported before ordering equipment.

2.2 EQUIPMENT

2.2.1 Safety

Medical and dental equipment shall meet the requirements of OSHA 21 CFR 701, NFPA 101, and UL 544. In lieu of UL approval, consideration will be given to certified test reports from an approved laboratory meeting UL 544 requirements.

2.2.2 Electrical Motors

Unless otherwise shown, equipment with motors of 1/2 horsepower or less shall be suitable for operation from a 120-volt,single-phase, 60 Hz supply. Motors shall be of sufficient size for the duty to be performed and shall not exceed the nameplate rating when driven equipment is operating at specified capacity under the most severe conditions. Fractional horsepower motors shall conform to NEMA MG 1 and UL 674.

2.2.3 Backflow Preventers

Reduced pressure principle type conforming to the applicable requirements of AWWA C510, AWWA C511 and FCCCHR-USC.

2.3 COMPONENTS

2.3.1 Mechanical

Components, such as piping, valves, and controls, shall conform to the requirements specified in Section 15405, PLUMBING, HOSPITAL.

2.3.2 Electrical

Provide components of equipment and systems, such as motors, starters, and controls as specified for complete operable systems. Extended voltage-range motors are prohibited. Provide interconnecting wiring for components of packaged equipment as an integral part of the equipment. Provide interconnecting power wiring and conduit for field-erected equipment and control wiring and conduit shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Motor control equipment forming part of the motor control centers or switch gear assemblies and the necessary conduit and wiring connecting such assemblies, centers, or other power sources to the equipment shall be as specified in Section 16415 ELECTRICAL WORK, INTERIOR.

2.4 LOGCAT "A" Items

Items shall conform to the requirements listed below.

All submittals shall include the proper item nomenclature and JSN for the project.

2.4.1 JSN A5125 Rack, Crutch, Wall Mounted

Wall mounted cane and crutch rack 1676mm long capable of holding up to 3 dozen pairs. Construction shall be of steel tubing with rubber coated hangers and welded joints.

Similar to Preston Model 7297, or approved equal.

2.4.2 JSN L2250 Hood, Fume, Bench

Bench-type fume hood shall 1219mm wide be designed to utilize semi-tempered outside air when total fume exhaust volume exceeds room exhaust volume required. Shall be constructed with full-view, laminated safety glass

vertical sash; full-width recessed pull; 724mm opening; gravity-actuated sash stop at 457 mm height with override capability, in the sash enclosure. The fume hood shall have a fixed baffle with optional multi-position single-point adjustment with remote outside control. Item shall have side-wall access panels with PVC gasket, two-tube fluorescent light fixture, light switch, and two duplex 120-volt AC receptacles.

Similar to Fisher Hamilton 54L625, or approved equal.

2.4.3 JSN A5220 Bracket, Television, Wall Mounted

TV wall bracket shall be complete assembly with wall mounting plate, adjustable tilt wall swivel bracket with load capacity of 68kg minimum, and maximum space capacity for 689mm color receiver. Baked enamel finish - Item shall be of heavy gauge steel construction. Item shall allow a total swivel of 66 degrees and an infinitely adjustable tilt from 0 to 15 degrees. Item will be supplied with bracket, yoke assembly and interior wall mounting plate. There shall be a minimum head clearance of 2032mm when installed to 2591mm ceiling.

Similar to Peerless Industries Model JME 650D, or approved equal.

2.4.4 JSN M0041 Booth, Audio, Double Wall, 10 Pesrson

Items shall function as room for testing patient acuity of hearing. Items shall be of double wall construction as indicated for individual items. All rooms shall be RF shielded. All rooms shall contain HVAAC system integration.

Floor Construction: The acoustical floor shall be a minimum of 102mm thick. Floors shall rest on full length vibration isolation rails of welded construction to reduce structurally transmitted vibration. Rails shall incorporate properly loaded rubber-in-shear (50 durometer rubber) vibration isolators to provide 5-1/4 Hz natural frequency. The suite shall contain acoustical floors in both the examination and control rooms. Floor shall be sealed with a minimum 1.6 mm cold-rolled steel bottom skin and shall be fully insulated with acoustical fill material. The perimeter shall be constructed of a minimum 3.2 mm steel channel. Steel internal reinforcement members shall be place on 305mm maximum centers, Walking surface shall be a minimum of 3.2 mm cold-rolled steel with nylon filament carpet. The perimeter of the floor shall be finished with a 1.6 mm cold-rolled steel apron finished to coordinate with the rooms overall color.

Wall and Roof Construction: The wall and roof panels shall be constructed of minimum of 102mm acoustical panels. Panels shall be fabricated of a minimum 1.6 mm, cold-rolled steel outer skin and a minimum 0.8 mm, perforated, cold-rolled steel inner skin. Perforations shall be 1.6mm diameter holes of 5mm staggered centers providing a 23% open area. Panels shall have internal framing members, with a minimum spacing of 607mm on center. All framing members, with shall be constructed of a minimum of 1.6 mm cold-rolled steel. Panels shall be fully insulated with acoustical fill material. Wall and roof panels have a minimum rating of STC 47 when tested in accordance with ASTM E413-73.

Joiners: The wall and roof panels shall be joined with a minimum 1.6 mm cold-rolled steel “H” type joiners, welded to form and acoustical labyrinth to ensure acoustical integrity at joints.

Acoustical Fill: Walls, roof, and floor panels shall be fully insulated with inert mildew and vermin resistant, non-combustible acoustical fill material that has been lab tested in accordance with the procedures of ASTM E84 to conform fire hazard rating of not greater than; Flame Spread 20, Fuel Contribution 15, and Smoke Density 20. Thermal conductivity shall not exceed K=.240.

Doors: Door leaves and frames shall be constructed compatible with the wall and roof panels. The door shall have a clear opening of 813mm width by 1880mm high. Door shall be sealed with double magnetic seals which shall not be broken at the door hinges. Doors shall contain a compression seal at the bottom of the door which shall be seated by the action of camlift hinges. Doors shall be mounted on camlift surface mounted hinges, with nylon cams which shall allow removal of the door leaf without removal of hinge parts. Camlift hinges with metal cams requiring periodic lubrication shall not be accepted. Door panel shall have a minimum rating of STC 52 when tested in accordance with ATSM E90-85 and ASTM E413-73.

Windows: Windows shall be constructed of double glazed 6.35mm minimum thickness. Laminated acoustical safety glass. Glass hall be mounted in neoprene seals with a minimum of 100 mm airspace which shall be filled with acoustical insulation to dampen window resonance. Desiccant material shall be installed between window panes to prevent condensation. Desiccant and insulation shall be covered by a black, 0.8 mm, perforated cold-rolled steel window liner to present an attractive window finish-out. The window shall be a minimum of 762mm wide by 607mm high and bottom of the window shall be 991mm above the floor.

Closure Panels: Audiometric rooms will be provided with a minimum of 0.8 mm ceiling closure panel to cover the area between the top of the room and finished ceiling. Color of panel shall match finish of room as required. Panel shall be provided with air louvers.

Electrical: All interior electrical components shall be pre-wired using 19mm flexible conduit and be recessed in the walls. Surface mounted wiring and wire mold components shall be U.L. approved and wired to N.E.C. codes for pre manufactured buildings. There shall be independent switches to control lights and fans separately. Suite shall be provided with four each duplex receptacles in the control room for JSN M0041.

Lighting: Suite(JSN M0041) shall be provided with a minimum of four each recessed incandescent lighting fixtures, two in control room and two in examination room. Lighting in the examination room shall be capable of being dimmed by dimmer control located in control room. The incandescent fixtures shall have a glass lens and be recessed in he ceiling. Lighting levels shall be a minimum of 645 lux of light at 914mm above finish floor.

Jack Panel: Shall be constructed of aluminum, acoustically sealed and located below the window. Jack panel faces shall be clearly numbered and installed flush into panel at factory. Jack panel shall contain 10 each Switchcraft, three conductor, 6.35mm phono stereo plugs, 1 each three pin,

Cinch Jones connector, 1 each Four pin Cinch Jones connector and 1 each Switchcraft, three conductor Cannon Microphone plug.

Ventilation System: Shall contain a silenced ventilation system that provides a minimum of one complete air change every two minutes. Ventilation system shall be designed with a fan forced silencer that circulates conditioned room air through the booth and returns the air to the host space. Silencers shall be designed such that the noise introduced into the examination room as a result of ventilation does not exceed the levels specified by ANSI S3.1-1977, ears uncovered. All ventilation silencers shall be mounted on roof panels.

Acoustical Test Data: Manufacturer shall submit laboratory test data from a laboratory accredited by the National Bureau of Standards National Voluntary Laboratory Accreditation Program (NVLAP) which demonstrates that the manufacturer has the capability of manufacturing and installing an audiometric booth that meet industry minimum requirements. All noise reduction test data shall have be conducted in accordance with ASTM E596-88 and shall have been conducted within the last 3 years to certify that performance is indicative of current production models. Sound absorption test shall have been conducted accordance with ASTM C423-84a and shall have a panel weight equal to the average panel weight of the panels used in the noise reduction tests.

Finish: Suite shall comply with General Specifications Above. Size shall be as indicated on Drawings.

(JSN M0041) Similar to Acoustic Systems Model RM-283 with HVAC System integrated option, or approved equal.

2.4.5 JSN M7405 Light, Exam, Ceiling Mounted

Item shall be a ceiling mounted examination light, for minor surgery and obstetrical procedures.

Color -corrected and heat filtered: A universal focus of light focus of light beam through a 914mm travel pre-focused light beam and easily adjusted lamp head.

Electrical Requirements: Light shall be 120 volt and meet the national electrical code as prescribed in NFPA NO. 56A and UL listed.

Suspension and Articulation: The arm shall consist of two sections. The first shall be 660mm and is attached to a tube by a bearing, and shall rotate through 360 degrees about the tube. The second section shall be an arm and yoke combination that permits 483mm vertical travel upward from horizontal. The yoke shall rotate 285 degrees. The lamp head shall rotate 180 degrees about it’s own axis.

Illumination: Illumination shall be a minimum of 43055 lux at the center of a spot 914mm from lower rim of the lamp head with the lamp head in a horizontal position. Illumination shall be distributed over the field and have shadow reduction qualities such that the hands of the surgeon and assistants will not cause appreciable shadows. The light beam shall color-correct to provide color temperature of approximately 4800 degrees Kelvin.

Similar to MDT Castle Model 2410C or approved equal.

2.4.6 JSN X3990 Illuminator, Film, Four Panel, Wall Mounted

Item shall have a continuous viewing surface of a minimum 1422mm x 432mm, wall mounted, stainless steel roller gravity film retainer mounted along the top of the unit. Each illuminator viewing panel shall be dual switched with a standard rocker type, double pole, single-throw switch. Unit shall be constructed of heavy gauge steel. Unit shall be provided with 3-wire line cord.

Similar to S&S X-Ray Products Model No. 224ST, or approved equal.

| [AM#2]
| 2.4.7 JSN R4400 Icemaker, Cubes
|
| The icemaker shall be self-contained and ideal for counter installation. The ice machine and storage bin shall be in one compact cabinet. The machine shall be serviceable from the front, and feature large bin openings for convenient ice removal.
|
| Similar to Scotsman Model No. SCE170A-1A, or approved equal.
|
| PART 3 EXECUTION

3.1 EXAMINATION

Before laying out the equipment, inspect the site of work. Report to the Contracting Officer damage to the building, including piping and wiring systems related to and affecting the installation of the equipment.

3.2 PROTECTION

Make provisions to prevent electrolysis where dissimilar metal parts are welded or otherwise fastened together.

3.3 INSTALLATION

Set and connect the equipment plumb and true to level in accordance with the manufacturer's instructions and recommendations. Attach items and accessories. Make connections between equipment and other work in a neat manner, and install the equipment so as not to damage other work.

3.3.1 Mounting

Mount the equipment according to SMACNA SRM seismic restraints guidelines.

3.3.2 Operation

Provide all items necessary to make equipment operational.

3.4 FIELD INSPECTION

Notify the Contracting Officer 5 days before the scheduled inspection. Perform acceptance inspection of the finished work with the Contracting Officer to examine each item to ensure that the equipment is operational.

3.5 CLEANING AND ADJUSTING

Clean and adjust equipment. Lubricate moving parts, and test the equipment in accordance with the manufacturer's instructions. Clean the medical equipment, both inside and outside. Ensure that equipment is free from defects.

3.6 OPERATING AND MAINTENANCE DATA

Attach a copy of the operation and maintenance data for each piece of equipment to its respective equipment.

3.7 FIELD TRAINING

| [AM#2] Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total 24 hours of normal working time and start after the equipment is functionally completed but prior to final acceptance. The field instructions shall cover all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations. Training shall be scheduled on Tuesdays, Wednesdays, or Thursdays and the training shall be video taped (VHS format) and two copies of the tape provided the C.O.R..

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 12335

CASEWORK FOR MEDICAL FACILITIES

PART 1 GENERAL

The following schedule contains a listing of the equipment items that are identified by a Joint Schedule Number (JSN). The listing contains the JSN, nomenclature, Logistical responsibility, and specification reference. The requirements for individual items of equipment are contained in the appropriate portion of these specifications as indicated in this schedule.

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 920-\ (1987) Elastomeric Joint Sealants

1.2 LOGISTICAL CLASSIFICATION

Methods of procurement are defined as follows:

a. Category A: Contractor Furnished and Contractor Installed (CF/CI).

b. Category B: Government Furnished and Contractor Installed (GF/CI).

c. Category C: Government Furnished and Government Installed (GF/GI).

d. Category D: Other (leased or rented equipment or that obtained under special conditions. Funds will be determined by the using service.)

e. Category E: Government Furnished and Contractor Installed (GF/CI). (Procurement to be delayed until the latest date feasible that will not interfere with project completion. This will provide the latest Model of equipment at the time it is needed.)

f. Category F: Government Furnished and Government Installed (GF/GI). Procurement to be delayed until the latest date feasible that will not interfere with project completion. This will provide the latest model of equipment at the time it is needed. Equipment designated Logistical Category "B", "C", "E", and "F" will be Government provided. For equipment installed by the Government, the Contractor shall make preparations for installation, as indicated.

1.3 SUBMITTALS

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

SD-04 Data\

Casework\; *GA*\.

Manufacturer's printed data, catalog cuts, and instructions for installation and cleaning.

SD-04 Drawings\

Casework\; *GA*\.

Drawings showing each type of cabinet and related item. The drawings shall clearly indicate the complete plan and elevations of the cabinets and accessories and pertinent details of construction, fabrication, and attachments.

SD-13 Certificates\

Casework\; *GA*\.

Certificates attesting that the casework meets the requirements specified.

SD-14 Samples\

Casework\; *GA*\.

In lieu of individual samples, complete minimum size casework may be furnished as samples. Mock-up units are not acceptable. Samples shall be of sufficient size to show color, pattern, and method of assembly. Metal casework samples shall be in the color(s) specified on the drawings.

a. Counter top and backsplash - One section, containing both.

b. Door and drawer front - One of each, with hardware mounted.

c. Melamine plastic color samples approximately 51 mm by 76 mm size.

d. Stain/color samples shall be approximately 51 mm by 76 mm size.

1.4 DELIVERY AND STORAGE

Casework shall be delivered to the jobsite wrapped in a protective covering. Casework shall be stored in an adequately ventilated, dry location that is free of dust, water, or other contaminates and in a manner to permit access for inspection and handling. Casework shall be handled carefully to prevent damage to the surfaces. Damaged items that cannot be restored to like-new condition shall be replaced.

PART 2 PRODUCTS

2.1 LOGCAT "A" CASEWORK

| [AM#2] Casework shall be as shown on the drawings. The casework shall be factory fabricated of manufacturer's standard sizes and finishes and the requirements specified below. All drawers shall be manufactured with stops that shall prevent the drawers from inadvertently coming out all the way.

Devices that allow the drawer to be completely removed shall be installed. Material finish and color shall be as specified on drawings. ~~in accordance with SECTION 09915 COLOR SCHEDULE.~~

2.1.1 Medical Casework

Medical casework shall be baked enamel carbon steel.

2.1.2 Countertops

Counter tops shall be corrosion-resisting steel, plastic laminate covered plywood, plastic laminate covered particleboard, modified epoxy resin or resin coated laminated pressed wood fiber as indicated in paragraph CLASSIFICATION AND DESCRIPTION OF CASE WORK.

2.1.3 Counter Sinks

Counter sinks shall be stainless steel. Sinks shall be of bowl sizes and depths indicated in paragraph CLASSIFICATION AND DESCRIPTION OF CASE WORK, first dimension - front to back, second dimension - width and third dimension - depth. Double compartment sinks may be used in areas where two separate sinks are indicated in a single cabinet on the drawing provided the bowl sizes are identical. All sinks shall be supplied with stainless steel center outlet strainer and tailpiece. Plumbing fixtures shall be deck mounted with gooseneck swing faucet and 102 mm wrist blades. (Similar to Hamilton Industries Model 32L469)

2.1.4 Cabinet Locks

[AM#2] Keyed cabinet door locks shall be provided in the following rooms and casework~~:~~. Provide six (6) keys for each keyed cabinet and each cabinet shall be keyed separately.

Room	Case Work	
A081	CE030	CE040
A082	CE030	CE040
A086	CE030	CE040
B068	CE030	CE040
B095	CE030	CE040
B099	CE030	CE040

PART 3 EXECUTION

3.1 INSTALLATION

[AM#2] Casework shall be located as indicated. The installation of the casework shall not damage the work of other trades. The casework shall be secured in place in true alignment, level, and plumb. Units shall be secured with screws through to cleats that have been anchored to building structure with toggle or expansion bolts. Wall-hung cabinets shall be installed to support the weight of the cabinets plus the normally expected

weight of the contents of the cabinets. Fasteners shall be spaced 305 mm on center using at least three bolts in each 914 mm or 1219 mm unit width. Adjoining cabinets in an assembly shall be joined together at top and bottom with inconspicuous bolts or clips. Cabinets shall be bolted to bases at cabinet corners. Metal bases shall be faced with resilient material similar to the base provided for the space adjacent to the cabinets. Where base cabinets and counters are removable, wall anchors shall be readily accessible. Joints between the casework and wall surfaces which are not larger than the joints between casework sections shall be sealed flush with sealant conforming to ASTM C 920, Type M, Grade NS, Class 25, Use NT. Larger joints shall be closed with filler strips of the same material and finish as adjacent casework. Filler strips shall be cut to the contour of the wall surface and secured to the casework with concealed nails or screws. Width of filler strips shall not exceed 152 mm in width. Metal cabinets in rooms having sheet vinyl flooring and integral cove base shall receive the same integral cove base after cabinets are in place and anchored. Height of counter tops shall be as indicated on the drawings. Where required, toe space at front of cabinets shall be provided by installing front face of cabinets 76 mm in front of face at base and shall have a height of approximately 102 mm. All items shall be installed as required for proper operation in accordance with the manufacturer's directions. Mounting plates shall be provided the full width or length of the wall hung cabinets both top and bottom plates as detailed on #12, Sequence #080.

3.2 CLEANING

Cabinets and countertops shall be cleaned in accordance with manufacturer's instructions.

3.3 CLASSIFICATION AND DESCRIPTION OF CASEWORK

Medical and dental casework is classified in accordance with the five digit JSN numbering system. Casework shall be of the JSN’s indicated on the drawings. The equipment and casework listed below are Contractor furnished - Contractor installed (CF/CI).

JSN	DESCRIPTION
C0037	Apron rail; legs as required, 114 mm H x L - As Required(AR): Similar to Hamilton Industries Model 500S403, or approved equal.
C0044	Apron frame with Drawer, 559 mm D x 114 mm H x 762 mm L. Similar to Hamilton Industries Model 501S222, or approved equal.
C0045	Apron Frame with 2 Drawers, 559 mm D x 114 mm H x 914 mm L. Similar to Hamilton Industries Model 502S220, or approved equal.
C0047	Apron Frame with 3 Drawers, 559 mm D x 114 mm H x 1524 mm L. Similar to Hamilton Industries Model 503S221, or approved equal.

C01C0 Cabinet, Under Counter Base Unit, With Hinged Single Door.

One full width-width drawer and one adjustable shelf, 457 mm D x 559 mm L x 889 mm H - Provide left or right hand door as indicated on drawing.

Similar to Hamilton Industries Model 136S232, or approved equal.

C01Q0 Cabinet, Under Counter Sink Unit with Hinged Single Door.

Provide left or right hand door as indicated on drawing.

Similar to Hamilton Industries Model 113S232 or approved equals.

C02C0 Cabinet, Under Counter Base Unit with Hinged Single Door, One Full-Width Drawer and One Adjustable Shelf.

Provide left or right hand door as indicated on drawings, 610 mm W x 559 D x 889 mm H.

Similar to Hamilton Industries Model 136S432 and 137S432 or approved equals.

C02Q0 Cabinet, Under Counter Sink Unit with Single Hinged Door:

Provide left or right hand door as indicated on drawings 610 mm W x 559 mm D x 746 mm H.

Similar to Hamilton Industries Model 112S422 and 113S422 or approved equals.

C03G0 Cabinet, Under Counter Base Unit with double hinged solid doors 762 mm W x 559 mm D x 889 mm H.

Similar to Hamilton Industries Model 106S532 or approved equal.

C03H0 Cabinet, Under Counter Base Unit with five drawers, 762 mm W x 559 mm D x 889 mm H.

Similar to Hamilton Industries Model 194S532 or approved equal.

C03J0 Cabinet, Under Counter Base Unit with Eight Equal Height, Half-Width Drawers, 762 mm W x 559 mm D x 889 mm H.

Similar to Hamilton Industries Model 206S532 or approved equal.

C03L0 Cabinet, Under Counter Base Unit with Hinged Single Door, One 14 mm H Full-Width Drawer, One 114 mm H Half-Width Drawer and Two 178 mm H Half Width Drawers.

Provide left or right hand door as indicated on drawings 762 mm W x 559 mm D x 889 mm H.

Similar to Hamilton Industries Model 174S532 and 175S532 or approved equals.

C03P0 Cabinet, Under Counter Sink Unit with Hinged Double Doors, 762 mm W x 559 mm D x 889 mm H.

Similar to Hamilton Industries Model 115S532 or approved equal.

C04E0 Cabinet, Under Counter Base Unit with Hinged Double Doors, One Full-Width Drawer and One Adjustable Shelf, 914 mm W x 559 mm D x 889 mm H.

Similar to Hamilton Industries Model 146S632 or approved equal.

C04G0 Cabinet Under Counter Base Unit With Hinged Double Doors, One full width drawer and Two Adjustable Shelves, 914 mm W x 559 mm D x 889 mm H.

Similar to Hamilton Industries Model 146S632 or approved equal.

C04J0 Cabinet, Under Counter Base Unit with Eight Equal Height, Half-Width Drawers, 914 mm W x 559 mm D x 889 mm H.

Similar to Hamilton Industries Model 206S632 or approved equal.

C04L0 Cabinet, Under Counter Base Unit with Hinged Single Door, One 114 mm H Full-Width Drawer, One 114 mm H Half-Width Drawer and Two 178 mm H Half-Width Drawers:
Provide left or right hand door as indicated on drawings 914 mm W x 559 mm D x 889 mm H

Similar to Hamilton Industries Model 174S632, or approved equals.

C05J0 Under Counter Base Unit with Eight Equal Height, Half-Width Drawers, 1219 mm W x 559 mm D x 889 mm H: Similar to Hamilton Industries Model 174S832 or approved equals.

Similar to Hamilton Industries Model 206S832 or approved equal.

C05P0 Cabinet, Under Counter Sink Unit with Hinged Double Doors, 1219 mm W x 559 mm D x 889 mm H.

Similar to Hamilton Industries Model 115S832 or approved equal.

C06D0 Cabinet, Under counter Base Unit with Four Full-Width, Equal Height Drawers, 457 mm W x 559 mm D x 762 mm H.

Similar to Hamilton Industries Model 145S222 or approved equal.

C06M0 Cabinet, Under counter Base Unit with Two 114 mm H and One 260 mm H Full-Width Drawers, and one Pull Board Drawer.

Similar to Hamilton Industries Model 130S222 or approved equal.

CA020 Cabinet, Wall Hung, Open Face with Two Adjustable Shelves and Sloping Top, 762 mm W x 330 mm D x 787 mm H.

Similar to Hamilton Industries Model 730S533 with 532M106 or approved equals.

CC010 Cabinet, Wall Hung, with Hinged, Framed Glass, Single Door, Two Adjustable shelves and Sloping Top, 457 mm W x 330 mm D x 787 mm H.

Provide left or right hand door as indicated on drawings.

Similar to Hamilton Industries Models 708S233 and 709S233 with 532M103 or approved equals.

CE030 Cabinet, Wall Hung, with Hinged, Framed Glass, Double Door, Two Adjustable shelves and Sloping Top, 762 mm W x 330 mm D x 787 mm H.

Provide left or right hand door as indicated on drawings.

Similar to Hamilton Industries Models 712S533 with 532M106 or approved equals.

CE040 Cabinet, Wall Hung, with Hinged, Framed Glass, Double Door, Two Adjustable shelves and Sloping Top, 914 mm W x 330 mm D x 787 mm H.

Provide left or right hand door as indicated on drawings.

Similar to Hamilton Industries Models 712S633 with 532M107 or approved equals.

CS010 Counter Sink, 305 mm x 305 mm x 190.5 mm

Similar to Hamilton Industries Model 52L915L with 324L69, 34L224, and 34L018, or approved equal.

CS090 Counter Sink, 406 mm x 483 mm x 267 mm

Similar to Hamilton Industries Model 52L923L with 32L469, 34L224, and 34L018, or approved equal.

CS140 Counter Sink, 356 mm x 406 mm x 190.5 mm

Similar to Hamilton Industries Model 52L933L with 32L469, 34L224, and 34L018, or approved equal.

CS200 Counter Sink, 406 mm x 559 mm x 305 mm

Similar to Hamilton Industries Model 52L947L with 32L469, 34L224, and 34L018, or approved equal.

CT030 Plastic Laminated countertop

Plastic Laminated countertop shall be of the depths and lengths indicated on drawings. The countertop shall be a minimum of 31.75 mm thick. With a working surface and a 102 mm high splashback formed of one piece of plastic laminate with a minimum of 6.35 mm cove at intersection of top and splash back, Countertop front and sides, and splash back top and sides shall be covered with plastic laminate and be self edged. Intersections of all plastic laminate covered surfaces with the exception of post-formed intersection shall be a 90 degree nominal angle broken with an edge bevel to eliminate sharp line angles. Countertops 3658 mm or less in length shall be in one piece. Colors of plastic laminate shall be as specified on the drawings.

Similar to Hamilton Industries Plastic Laminated Counter Top or approved equals.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 12520

WINDOW TREATMENT

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.

NATIONAL FIRE PROTECTION (NFPA)

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

1.2 GENERAL

Window treatment shall be provided, complete with necessary brackets, fittings, and hardware. Each window treatment type shall be a complete unit. Equipment shall be mounted and operated as indicated. Windows to receive a treatment shall be completely covered. The Contractor shall take measurements at the building and shall be responsible for the proper fitting and hanging of the equipment.

1.3 SUBMITTALS

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

SD-01 Data\

Window Treatments and Hardware\; *FIO*\.

Manufacturer's data composed of catalog cuts, brochures, product information, and maintenance instructions.

SD-04 Drawings\

Window Treatments and Hardware\; *FIO*\.

Drawings showing fabrication and installation details. Drawings shall show layout and locations of track, direction of draw, mounting heights, and details.

SD-14 Samples\

Window Treatments and Hardware\; *FIO*\.

Three samples of each type and color of window treatment. Track shall be 150 mm in length. Shade material shall be minimum 150 by 150 mm in size.

1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling. Materials shall be stored flat in a clean dry area with temperature maintained above 10 degrees C.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 WINDOW SHADES

Roller tube shall operate smoothly and be of sufficient diameter and thickness to prevent excessive deflection. Steel features shall be treated for corrosion resistance.

2.1.1 ROOM DARKENING (TRACKED) SHADES

Room darkening (black-out tracked) window shades shall conform to the following: Roller tube shall be aluminum and shall be controlled by webbing tape. Light traps shall be shop fabricated, and shall consist of a head box to house the shade roller, and U-shaped channels to serve as guides for the shade along the sides and to receive the bottom edge of the shade along the sill. Light trap shall be made of sheet steel having a minimum thickness of 0.85 mm or extruded, aluminum. The legs of the channels shall be not less than 44 mm long and separated by the minimum distance that will permit free operation of the shade. Edges of light trap coming into contact with the shade cloth shall be smooth pile light seal. The exposed face of the head box shall be hinged or removable for access to the shade roller. The interior or unexposed surfaces of the light trap shall have a finish coat of flat black enamel. The exposed portions of the light trap shall have a factory-applied priming coat of gray paint. Finish painting is specified in Section \=09900=\ PAINTING, GENERAL. Shade roller shall be manufacturer's standard product. Cloth shall be of type for blackout purposes. The shade shall be made from a single piece of fiberglass cloth sandwiched between sun resistant vinyl. The shade cloth shall meet the performance described in \-NFPA 701-\, small scale test. When not finished with a selvage, the vertical edges of the shade shall be bound or hemmed using a high-grade thread. Needle holes shall be made lightproof by applying a suitable filler. The bottom edge of the shade shall be fitted with a steel operating bar. Shades will engage positively with bottom rail through operating bar or chain pull. Bars shall be painted with flat black enamel. Pull cords shall be made of No. 4 braided nylon or beaded chain having not less than 335 N breaking strength.

2.1.1.1 Color

Exterior color of shade cloth shall be white, and interior color shall be equal to Draper SunBloc "Putty" SB9140.

| 2.1.1.2 [AM#2] Location
|
| Provide room darkening tracked shades at Conference Room B017.
|
| PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the approved detail drawings and manufacturer's installation instructions. Units shall be level, plumb, secure, and at proper height and location relative to window units. The Contractor shall furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Installation shall not be initiated until completion of room painting and finishing operations. Upon completion of the installation, window treatments shall be adjusted for form and appearance, shall be in proper operating condition, and shall be free from damage or blemishes. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

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SECTION 13090

X-RAY SHIELDING

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 749	(1985; R 1991) Lead and Lead Alloy Strip, Sheet, and Plate Product
ASTM C 36	(1997) Gypsum Wallboard

NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS (NCRP)

NCRP Rpt 35	(1970) Dental X-Ray Protection
NCRP Rpt 49	(1976) Structural Shielding Design and Evaluation for Medical Use of X-Rays and Gamma Rays of Energies up to 10 MeV
NCRP Rpt 102	(1989) Medical X-Ray, Electron Beam and Gamma-Ray Protection for Energies up to 50 MeV (Equipment Design, Performance and Use)

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)

NWWDA I.S. 1	(1997) Wood Flush Doors

1.2 SYSTEM DESCRIPTION

X-ray shielding shall be constructed such that it is not impaired by joints, openings for ducts, pipes, or other openings through shielding, or conduits, service boxes, and other items embedded in the shielding. The shielding shall appear to be continuous. Lead patches, lead sleeves, and/or mazes shall be installed as required to provide continuity of the shielding. Sleeves shall be not less than 25 mm in length. Thicknesses indicated for shielding are minimum acceptable thickness.

1.3 SUBMITTALS

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

SD-01 Data

Materials; FIO.

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

SD-04 Drawings

Materials; FIO.

Drawings indicating thickness of lead at all locations; construction at floor, walls, ceiling, and columns; details of lead laps and lap securing methods; fastenings, profiles, details of items and accessories penetrating the shielding materials; and any special method of construction.

SD-13 Certificates

Materials; FIO

Certification indicating the shielding materials supplied complies with specified quality and thicknesses.

SD-14 Samples\

Hardwood veneer plywood panels\; *GA*\

200 by 250 mm sample of each specified panel.

1.4 QUALIFICATIONS

Work shall be performed by a company which specializes in the type of shielding work required by Contract documents. Company shall have a minimum of 10 years of documented successful experience.

1.5 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered in the original containers bearing the name of the manufacturer and brand name. Shielding materials shall be stored off the ground under watertight cover. Damaged materials shall be removed from the premises.

1.6 WARRANTY

Lead sheet shielding materials shall be warranted against sagging and curling for 10 years.

PART 2 - PRODUCTS

2.1 LEAD SHEET

Lead sheet shall conform to ASTM B 749, Grade C, thickness as shown.

2.2 LEAD-LINED GYPSUM WALLBOARD

Lead-lined gypsum wallboard shall be a single thickness of unpierced lead laminated to 16 mm thick gypsum board conforming to ASTM C 36, Type III, Grade R, Class 1, Form a.

2.3 LEADED GLASS

Leaded glass shall be clear X-ray protective quality glass in single or multiple thicknesses. Leaded glass shall have lead equivalence required for the shield wall, door, or partition in which the leaded glass is installed.

2.4 LEAD-HEADED NAILS

Lead-headed nails may be used to accomplish shielding not less than that provided by the barrier. The size, type and design shall be recommended by the manufacturer of material to be installed.

2.5 LEAD TABS OR CLIPS

Lead tabs or clips shall be unpierced sheet lead not less than the thickness of lead in the barrier. Prior to folding, the tabs shall be rectangular in shape and shall be the required size to provide an effective lead lap over an unleaded nail, screw, or tie wire penetration when folded.

2.6 LEAD-LINED WOOD DOORS

Lead-lined wood doors shall be premium grade, book matched, hardwood veneer, solid core, in accordance with NWWDA I.S. 1. Lead sheet shall extend to door edges and provide x-ray absorption equal to the partition in which the door is installed. Face veneer for lead-lined doors shall be red oak to match other wood doors in the clinic for job finishing as specified in Section 09900 PAINTING, GENERAL. Doors shall have filler strips, crossbanding face veneers and hardwood edge strips glued under heavy pressure with contact adhesive.

2.6.1 Shielding

Cores shall be secured together with poured lead fasteners or steel bolts, using washers under heads and nuts. Bolts shall be spaced not more than 38 mm from edges around door perimeter and not more than 200 mm on centers in both directions. Bolts shall be countersunk and have poured lead or lead dowels covering heads and nuts flush with face of core. Door thickness shall be manufacturer's standard for lead thickness used, unless shown otherwise.

2.6.2 Painting and Sealing Doors

Top and bottom edges of doors to be painted shall receive two factory coats of spar varnish before shipment to jobsite. Doors to be stained or have a natural finish shall receive two shop coats of water-resistant sealer before shipment to jobsite.

2.6.3 Door Hardware

Door hardware shall be as specified in Section 08700 BUILDERS' HARDWARE. Mortises for floor hinge arms and top pivots with sheet lead and necessary lead plugs, sheet lead, stainless steel pans, bolts and screws shall be provided.

2.7 LEAD WINDOW FRAMES

Lead window frames for viewing windows mounted in lead-lined doors shall be constructed from extruded aluminum alloy with concealed lead lining, splayed on four sides for wide-angle viewing. Frames shall form a minimum overlap of

9 mm at the perimeter of the lead glass or twice the thickness of the shielding, whichever is greater. Thickness of lead shall be the same as the lead in the barrier in which they occur. Frames can be either solid or telescoping type. Lead stops shall be provided for glass installation.

2.8 LEAD LIGHTPROOF LOUVERS

Lead lightproof louvers for doors shall be fabricated entirely of lead of not less than the thickness of lead in barrier in which they are installed. Louvers shall be one-unit construction designed with a maze-type blade to exclude the passage of light. Louvers shall allow 30 percent free area for air circulation. Louvers shall be factory-fitted, boxed separately, and shipped with door or assembled before shipment.

2.9 LEAD-LINED STEEL DOOR FRAMES

[AM#2] Steel frames shall be ~~as specified in Section 08110 STEEL DOORS AND FRAMES~~Extra Heavy Duty per SSI-100. The inside of frames shall be lined with a single thickness of sheet lead. The thickness of the lead lining shall be the same as the lead lining of the system in which the frames are used. Linings shall be installed at the factory, and shall be continuous. Lining shall be formed to contour of frame. Lead shields shall be formed around areas prepared to receive hardware. Each lining shall be wide enough to provide and maintain an effective lead lap with the lead of the adjoining shielding units.

2.10 OPERATORS PROTECTIVE SCREEN

Operators protective screen shall be constructed of studs, surfaced with lead-lined gypsum wallboard conforming to ASTM C 36 secured to studs with appropriate fasteners, with lead washer or tabs. Plywood-hinged screens and fixed screens after installation shall be finished in the same manner as specified for doors. At corners, or where screen abuts a wall or floor, screen panels shall be joined to provide an effective lap of lead. Lead or lead-lined viewing window shall be built-in.

2.12 X-RAY DUCT SYSTEM

The X-ray duct system shall consist of floor, ceiling and wall duct with removable covers, internal duct barriers and partitions and necessary fittings, connectors and components to form a complete system. Duct dimensions shall be coordinated with room dimensions and wall construction. Duct requirements for barriers, fittings and components shall be coordinated with the x-ray system manufacturer.

Duct system shall be as follows:

Duct sides and bottom shall be steel with 1.9 minimum thickness unless otherwise noted.

Wall duct shall be flush mounted type, 254 mm wide by 90 mm deep with 305 mm wide screw-on cover plate. Provide a continuous internal partition to divide the duct into 2 separate, equally spaced sections. Wall duct shall be lead lined to provide same protection as indicated for wall in which it is a part.

Ceiling duct shall be surface mounted type, 254 mm wide by 90 mm deep with 254 mm wide screw-on cover plate. Provide a continuous internal partition to divide the duct into a minimum of two separate compartments.

Wall and ceiling duct covers shall be of steel construction with 1.9 mm minimum thickness. Covers for exposed wall duct shall be designed to receive finish to match and to install flush with the scheduled wall finish for the room. Where continuous wall mounted lighting fixtures are located in front of wall duct, cut covers and provide multiple cover sections so that wall duct covers may be removed above and below the light fixtures.

Floor duct shall be constructed of minimum 2.0 mm galvanized steel and shall be 305 mm wide by 90 mm deep with continuous internal partition to divide the duct into 4 separate, equally spaced sections.

Floor duct cover plates shall fully gasketed and removable. Covers shall be 457 mm long and made of nominal 6.3 mm roller leveled steel with lap joints. Top cover assembly shall permit free access to the full length of the floor duct. No straps or cross bars shall be installed for cover support. Cover weight shall not exceed 22.7 kg per section. Cover plate screw holes shall accomodate flat head screws for a flush installation. Floor duct cover shall be suitable for installation of the specified floor covering material. Floor duct shall be installed flush such that the duct cover with matching floor covering material installed, shall be flush with the finished floor and installed floor covering material.

Provide radiographi/x-ray system/door interlock system interface wiring between switches in room doors and the x-ray duct system. Provide conduit from door switch locations to the x-ray duct and to the x-ray controller location. Door switches are provided as part of the door hardware. X-ray system/door interlock is to prevent operation of the x-ray system while room doors are open.

2.11 DESIGNATING PLAQUES

2.11.1 Required Information

Designating plaques shall be furnished and installed as specified below in rooms and as indicated on the drawings. Locations where shielding thickness changes, or is not continuous, shall be indicated on the plaque. Plaque shall be of aluminum, plastic, bakelite, or other approved materials and shall be of sufficient height and length to contain the required information as specified below.

2.11.2 Radiographic, Fluoroscopic, and Cystoscopic Rooms

One sign shall be provided for each room insulated with sheet lead lettered as follows:

"SURFACES OF THIS ROOM HAVE BEEN INSULATED WITH SHEET LEAD OF FOLLOWING THICKNESS TO A HEIGHT OF 2140 mm ABOVE FLOOR SLAB:

LEAD THICKNESS	TOTAL LEAD EQUIVALENT PROTECTION

DOORS	1.6 mm	1.6 mm
PARTITIONS	1.6 mm	1.6 mm

2.11.3 Rooms With Nonshielded Partitions

One sign shall be provided for each lead-shielded partition in a room for which all partitions are not shielded. A sign shall be located on lead-insulated partition and lettered as follows:

"THIS PARTITION HAS BEEN SHIELDED THE FULL HEIGHT WITH SHEET LEAD 1.6 mm THICK, PROVIDING A TOTAL LEAD EQUIVALENT PROTECTION OF 1.6 mm."

PART 3 - EXECUTION

3.1 INSTALLATION

Installation shall be performed in accordance with drawings and approved manufacturer's recommendations and NCRP Rpt 35, NCRP Rpt 49, and NCRP Rpt 102.

3.1.1 Workmanship

Sheet lead shall be installed free of waves, lumps, and wrinkles and with a minimum of joints. Joints in sheet lead shall provide protection equivalent to the protection provided by the adjacent sheet lead. Joints shall be finished smooth and neat.

3.1.2 Protection

Lead shields shall be used to maintain continuity of protection where unshielded built-in items penetrate lead linings. Where outlet boxes, junction boxes, ducts, conduits, and similar items prevent the use of shields, lead sleeves or lead lining shall be used. Fasteners shall not disrupt the continuity of shielding.

3.2 LEAD-LINED GYPSUM WALLBOARD

Lead-lined gypsum wallboard shall be applied over supports specified in Section 09250 GYPSUM WALLBOARD. Method of predrilling or drilling pilot holes shall not cause deformation of the fastener and shall not cause distortion of wallboard. Wallboard shall be applied vertically, with long edges parallel to supports, and with lead linings placed next to supports. Blocking shall be provided at end joints.

3.2.1 Joints

Sheet-lead strips not less than the lead thickness used for wallboard and not less than 38 mm wide shall be installed on blocking and supports at all joints.

3.2.2 Corner Joints

Corner joints shall consist of 45 mm by 45 mm lead angle.

3.2.3 Wood Supports

The sheet-lead strips shall be secured to blocking and supports at outer edges with wire nails. Edges of wallboard shall then be butt-jointed and fastened to supports with lead-headed nails at approximately 200 mm on centers at joints and 300 mm on center at intermediate supports with nail heads driven slightly below the surface of wallboard.

3.2.4 Metal Supports

Edges of gypsum wallboard at metal studs shall be fastened with 25 mm long lead-headed screws. Heads shall be covered with 13 mm diameter lead disc cemented to wallboard and installed flush with surface of wallboard.

3.2.5 Finish Ply

Gypsum wallboard not scheduled to be plastered shall receive a finish ply of gypsum wallboard bonded to the first ply with laminating adhesive as recommended by the wallboard manufacturer. Nailing the finish ply will not be permitted. A shoring system shall be used to hold finish ply in place during adhesive drying period. Shoring shall be left in place at least 24 hours. Joint and corner treatment shall be as specified in Section 09250 GYPSUM WALLBOARD.

3.3 LEAD DOOR THRESHOLDS

Thresholds shall be installed in accordance with approved detail drawings and shall be constructed as detailed on plans. Prior to installation, lead threshold surfaces in contact with concrete shall be painted with a coat of asphalt paint or latex material.

3.4 LEAD-LINED WOOD DOORS

Doors shall be fit, hung, and trimmed as required. Doors shall be installed with a clearance of 2 mm at sides and top and minimum adequate clearance at bottom. Lock edge shall be beveled 3 mm and hardware shall be adjusted as required. Warp or twist of lead-lined doors after doors have been hung and finished shall not exceed 6 mm in any face dimension of door including full diagonal. Cuts required for installation shall be sealed with a clear varnish or sealer.

3.4.1 Door Hardware

Bolts and screws which penetrate lead lining shall be recessed on the side of the door opposite hardware and shall be plugged with lead plugs to match face of door. Nuts for securing surface-applied hardware such as hinges, door closers and automatic door operators shall be countersunk and covered with lead-lined 1.59 mm thick stainless steel pans. Stainless steel pans shall be secured with round-head screws with dull chromium-plated finish. Cutouts for lock sets and latch cases shall be patched with sheet lead. Lead lining of the lock set and lead lining of the door shall be lapped to provide x-ray absorption equal to the door.

3.4.2 View Windows

View windows shall be installed in doors with hardwood stops to match face veneer. Stops shall be glued to door on corridor side and shall be fastened with countersunk oval head screws or finishing nails.

3.5 X-RAY DUCT SYSTEM

X-ray duct system shall be installed at the locations shown and according to the manufacturer's recommendations.

3.6 TESTING AND CERTIFICATION

Prior to completion of the x-ray shielded rooms, the contractor shall employ a qualified independent laboratory to test/survey the x-ray shielding for each x-ray room. The qualified expert performing the test shall be qualified as defined in NCRP Rpt 35, NCRP Rpt 49, and NCRP Rpt 102. Survey shall be performed in accordance with NCRP Rpt 35, NCRP Rpt 49, and NCRP Rpt 102. Four copies of surveyor's report shall be furnished to the Contracting Officer. Any part of x-ray shielding work found to be defective shall be corrected or replaced, including all other work affected thereby. The x-ray equipment will be installed by others after acceptance of the shielded rooms by the Government. After the equipment has been installed the government will have the shielded rooms surveyed by a qualified expert. The installation/survey may require 6 months more to accomplish. Any part of the x-ray shielding work found to be defective shall be immediately corrected or replaced by the contractor, including all other work affected thereby.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 15250

THERMAL INSULATION FOR MECHANICAL 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. At the discretion of the government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 167-\	(1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
\-ASTM A 580-\	(1995) Stainless and Heat Resisting Steel Wire
\-ASTM A 641-\	(1992) Zinc-Coated (Galvanized) Carbon Steel Wire
\-ASTM B 209-\	(1995) Aluminum and Aluminum-Alloy Sheet and Plate
\-ASTM C 195-\	(1990) Mineral Thermal Insulating and Cement
\-ASTM C 449-\	(1995) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
\-ASTM C 518-\	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
\-ASTM C 534-\	(1994) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
\-ASTM C 547-\	(1995) Mineral Fiber Pipe Insulation
\-ASTM C 552-\	(1991) Cellular Glass Thermal Insulation
\-ASTM C 553-\	(1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
\-ASTM C 612-\	(1993) Mineral Fiber Block and Board Thermal Insulation

\-ASTM C 647-\	(1995) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
\-ASTM C 795-\	(1992) Thermal Insulation for Use in Contact With Austenitic Stainless Steel
\-ASTM C 871-\	(1995) Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions
\-ASTM C 916-\	(1985; Rev 1990) Adhesives for Duct Thermal Insulation
\-ASTM C 920-\	(1994) Elastomeric Joint Sealants
\-ASTM C 921-\	(1989 R; 1996) Determining the Properties of Jacketing Materials for Thermal Insulation
\-ASTM C 1126-\	(1989) Specification for faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
\-ASTM D 3278-\	(1989) Test Methods for Flash Point of Liquids by Setaflash Closed-Cup Apparatus
\-ASTM E 84-\	(1995a) Surface Burning Characteristics of Building Materials
\-ASTM E 96-\	(1995) Water Vapor Transmission of Materials

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

\-MSS SP-69-\	(1991) Pipe Hangers and Supports - Selection and Application

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

\-MICA-01-\	(1993) National Commercial & Industrial Insulation Standards

1.2 SYSTEM DESCRIPTION

Field-applied insulation and accessories on mechanical systems shall be as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated. Field applied insulation materials required for use on Government-furnished items as listed in the SPECIAL CONTRACT REQUIREMENTS shall be furnished and installed by the Contractor.

1.3 GENERAL QUALITY CONTROL

1.3.1 Standard Products

Materials shall be the standard products of manufacturers regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

1.3.2 Installer's Qualifications

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.3.3 Surface Burning Characteristics

Unless otherwise specified, insulation not covered with a jacket shall have a flame spread rating no higher than 75 and a smoke developed rating no higher than 150. The outside surface of insulation systems which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread rating no higher than 25 and a smoke developed rating no higher than 50. Insulation materials located exterior to the building perimeter are not required to be fire-rated. Flame spread and smoke developed ratings shall be determined by \-ASTM E 84-\. Insulation shall be tested in the same density and installed thickness as the material that shall be used in the actual construction. Jackets shall comply with the flame spread and smoke developed ratings of 25/50 as determined by \-ASTM E 84-\.

1.3.4 Identification of Materials

Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material.

1.4 SUBMITTALS

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

SD-14 Samples\

Thermal Insulation Materials\; *FIO*\.

A complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories for each mechanical system requiring insulation shall be included. Materials furnished under this section of the specification shall be submitted at one time.

After approval of materials and prior to applying insulation a booklet shall be prepared and submitted for approval. The booklet shall contain marked-up \-MICA-01-\ plates (or detail drawings showing the insulation material and insulating system) for each pipe, duct, or piece of equipment which is/are required to be insulated per this specification. The MICA plates shall be marked-up showing the materials to be installed in accordance with the requirements of this specification for the specific insulation application. The Contractor shall submit all MICA Plates required to show the entire insulating system, including Plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. If the Contractor elects to submit detailed drawings instead of marked-up MICA Plates, the detail drawings shall show

cut-away, section views, and details indicating each component of the insulation system and showing provisions for insulating jacketing, and sealing portions of the equipment. For each type of insulation installation on the drawings, provide a label which identifies each component in the installation (i.e., the duct, insulation, adhesive, vapor retarder, jacketing, tape, mechanical fasteners, etc.) Indicate insulation by type and manufacturer. Three copies of the booklet shall be submitted at the jobsite to the Contracting Officer. One copy of the approved booklet shall remain with the insulation Contractor's display sample and two copies shall be provided for Government use.

After approval of materials actual sections of installed systems properly insulated in accordance with the specification requirements shall be displayed. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each manufacturer intended to meet the requirement. Display sample sections will be inspected at the jobsite by the Contracting Officer. Approved display sample sections shall remain on display at the jobsite during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

Pipe Insulation Display Sections: Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric unions and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and exterior, even when the same type of insulation is used for these services.

Duct Insulation Display Sections: Display sample sections for rigid and flexible duct insulation used on the job. A display section for duct insulation exposed to weather shall be protected by enclosing with a temporary covering.

1.5 STORAGE

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants by the Contractor. Insulation material and supplies that become dirty, dusty, wet, or otherwise contaminated may be rejected by the Contracting Officer.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials to be used on stainless steel surfaces shall meet \-ASTM C 795-\ requirements. Materials shall be asbestos free and conform to the following:

2.1.1 Adhesives

2.1.1.1 Acoustical Lining Insulation Adhesive

Insulation shall be applied in cut-to-size pieces attached to the interior of the duct with a nonflammable, fire-resistant adhesive conforming to \-ASTM C 916-\, Type I. Exposed edges of the liner at the duct ends and at other joints where the lining will be subject to erosion shall be coated with a heavy brush coat of the nonflammable, fire-resistant adhesive to prevent delamination of glass fibers.

2.1.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with \-ASTM C 195-\.

2.1.1.3 Lagging Adhesive

Lagging adhesives shall be nonflammable and fire-resistant and shall have flame spread and smoke developed ratings of 25/50 when measured in accordance with \-ASTM E 84-\. Adhesives shall be either the Class 1 or Class 2 type as defined here. Class 1 adhesive shall be pigmented white red and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bounding fibrous glass tape to joints of fibrous glass board; or for bonding lagging cloth to thermal insulation. Class 2 adhesive shall be pigmented white and be suitable for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations.

2.1.2 Contact Adhesive

Adhesive may be dispersed in a nonhalogenated organic solvent with a low flash point (flash point less than minus 3.9 degrees C when tested in accordance with \-ASTM D 3278-\) or, dispersed in a nonflammable organic solvent which shall not have a fire point below 94 degrees C. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not omit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 100 degrees C. The adhesive shall be nonflammable and fire resistant.

2.1.3 Caulking

\-ASTM C 920-\, Type S, Grade NS, Class 25, Use A.

2.1.4 Corner Angles

Nominal 0.4060 mm aluminum 25 by 25 mm with factory applied kraft backing. Aluminum shall be \-ASTM B 209-\, Alloy 3003, 3105, or 5005.

2.1.5 Finishing Cement

Mineral fiber hydraulic-setting thermal insulating cement \-ASTM C 449-\.

2.1.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth and glass tape shall have flame spread and smoke developed ratings of no greater than 25/50 when measured in accordance with \-ASTM E 84-\. Fibrous glass cloth and tape; 20 by 20 maximum size mesh. Tape shall be 100 mm wide rolls. Class 3 tape shall be 0.15 kg per square meter.

2.1.7 Staples

Outward clinching type \-ASTM A 167-\, Type 304 or 316 stainless steel.

2.1.8 Jackets

\-ASTM C 921-\, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 6.1 N/mm width. \-ASTM C 921-\, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 3.5 N/mm width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.1.8.1 White Vapor Retarder ASJ (All Service Jacket)

For use on hot/cold pipes, ducts, or equipment. Vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.1.8.2 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.4060 mm nominal thickness; \-ASTM B 209-\, Temper H14, Temper H16, Alloy 3003, 5005, or 3105 with factory applied moisture retarder. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.3960 mm thick, 12.7 mm wide for pipe under 300 mm diameter and 19.1 mm wide for pipe over 300 mm diameter. Aluminum jacket circumferential seam bands shall be 50.8 by 0.4060 mm aluminum matching jacket material. Bands for insulation below ground shall be 19.1 by 0.5080 mm thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburg or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.1.8.3 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.7620 mm. Insulation under PVC jacket shall meet jacket manufacturer's written recommendations.

2.1.9 Vapor Retarder Coating

The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall not exceed 0.05 perm and shall be determined according to procedure B of \-ASTM E 96-\

utilizing apparatus described in \-ASTM E 96-\. The coating shall be a nonflammable, fire resistant type. The flash point of the compound shall not be less than 26.7 degrees C and shall be determined in accordance with \-ASTM D 3278-\. All other application and service properties shall be in accordance with \-ASTM C 647-\.

2.1.10 Wire

Soft annealed \-ASTM A 580-\ Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

2.2 PIPE INSULATION MATERIALS

Pipe insulation materials shall be as follows:

2.2.1 Aboveground Cold Pipeline

Insulation for minus 34 degrees C to plus 16 degrees C shall be as follows:

2.2.1.1 Cellular Glass

\-ASTM C 552-\, Type II, and Type III.

| 2.2.1.2 [AM#2] DELETED _____.

| 2.2.1.3 [AM#2] DELETED _____.

2.2.2 Aboveground Hot Pipeline

For aboveground hot pipeline above 16 degrees C insulation the following requirements shall be met.

2.2.2.1 Mineral Fiber

\-ASTM C 547-\, Class 1 or Class 2 as required for the operating temperature range.

2.2.2.2 Cellular Glass

\-ASTM C 552-\, Type II and Type III.

| 2.2.2.3 [AM#2] DELETED _____.

2.2.3 Below ground Pipeline Insulation

\-ASTM C 552-\, Type II.

2.3 DUCT INSULATION MATERIALS

Duct insulation materials shall be as follows:

2.3.1 Rigid Mineral Fiber

\-ASTM C 612-\, Class 1.

2.3.2 Flexible Mineral Fiber

\-ASTM C 553-\, Type I, Class B-2.

2.3.3 Cellular Glass

\-ASTM C 552-\, Type I.

2.3.4 Phenolic Foam

\-ASTM C 1126-\ Type II. A maximum allowable leachable chloride content shall comply with \-ASTM C 795-\ when tested in accordance with \-ASTM C 871-\.

| 2.3.5 [AM#2] DELETED _____.

2.4 EQUIPMENT INSULATION MATERIALS

Equipment insulation materials shall be as follows:

2.4.1 Cold Equipment Insulation

For temperatures below 16 degrees C.

2.4.1.1 Cellular Glass

\-ASTM C 552-\, Type I, Type III, or Type IV as required.

| 2.4.1.2 [AM#2] DELETED _____.

2.4.1.3 Phenolic Foam

\-ASTM C 1126-\ Type II. A maximum allowable leachable chloride content shall comply with \-ASTM C 795-\ when tested in accordance with \-ASTM C 871-\.

2.4.1.4 Phenolic Foam

\-ASTM C 1126-\ Type II to 121 degrees C. A maximum allowable leachable chloride content shall comply with \-ASTM C 795-\ when tested in accordance with \-ASTM C 871-\.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests and heat tracing specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if aforementioned cleaning does not restore the surfaces to like new condition, the

insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA-01 standard plates except where modified herein or on the drawings.

3.1.2 Fire stopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with Fire stopping materials as specified in Section \=07270=\ FIRE STOPPING.

3.1.3 Painting and Finishing

Painting shall be as specified in Section \=09900=\ PAINTING, GENERAL.

| 3.1.4 [AM#2] DELETED _____.

3.1.5 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.6 Pipes/Ducts/Equipment which Require Insulation

Insulation is required, unless stated otherwise, on all pipes, ducts, or equipment, which operate at or below 15.6 C and at or above 26.7 C.

3.2 PIPE INSULATION INSTALLATION

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

a. Pipe used solely for fire protection.

b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.

c. Sanitary drain lines.

d. Unions in pipe above 16 degrees C.

e. Strainers in pipe above 16 degrees C.

f. Check valves in pipe above 16 degrees C.

g. Air chambers.

3.2.1.2 Pipes Passing Through Sleeves

a. Pipe insulation shall be continuous through the sleeve.

b. An aluminum jacket with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.

c. Where penetrating interior walls, the aluminum jacket shall extend 50 mm beyond either side of the wall and shall be secured on each end with a band.

d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 250 mm above the floor with one band at the floor and one not more than 25 mm from the end of the aluminum jacket.

e. Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 50 mm above the flashing with a band 25 mm from the end of the aluminum jacket.

f. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 50 mm beyond the interior surface of the wall.

g. Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor retarder coating. The insulations for exterior application shall butt tightly to the top of flashing and interior insulation. The exterior aluminum jacket shall extend 50 mm down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with caulking.

| h. [AM#2] In high abuse areas such as janitor closets and traffic areas in
| equipment rooms, kitchens, crawl spaces, and mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 1.5 m level shall be protected.

3.2.1.3 Pipes Passing Through Hangers

a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 50 mm and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with \-MSS SP-69-\. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 50 mm shall be installed.

b. Horizontal pipes larger than 50 mm at 16 degrees C and above shall be supported on hangers in accordance with \-MSS SP-69-\, and Section \=15405*\ PLUMBING, HOSPITAL.

c. Horizontal pipes larger than 50 mm below 16 degrees C shall be supported on hangers with the addition of a Type 40 protection shield in accordance with \-MSS SP-69-\. An insulation insert of cellular glass

or calcium silicate shall be installed above each shield. The insert shall cover not less than the bottom 180 degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 50 mm on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 25 mm, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with \-MSS SP-69-\ covering the 360 degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360 degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 50 mm on each end beyond the protection shield. When insulation inserts are required per the above, and the insulation thickness is less than 25 mm, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation as an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 9 m, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe which are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 38 mm, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible cellular insulation shall conform to \-ASTM C 921-\, Type 1, and is allowed to be of a different material than the adjoining insulation material.

| 3.2.1.4 [AM#2] DELETED _____.

3.2.2 Aboveground Cold Pipelines

The following shall be included for aboveground cold pipelines minus 34 degrees C to plus 16 degrees C:

a. Domestic cold and chilled drinking water.

b. Make-up water.

c. Horizontal and vertical portions of interior roof drains, and bottoms of roof drain pans.

d. Refrigerant suction lines.

e. Chilled water.

f. Dual temperature water, i.e. HVAC hot/chilled water.

g. Air conditioner condensate drains.

3.2.2.1 Insulation Thickness

Table I - Cold Piping Insulation Thickness

Type of Service	Material	Pipe Size (mm) Runouts up to 51 mm*	25 mm & less	32 - 51 mm	64 - 102 mm	127 - 152 mm	203 mm & larger
[AM#2]							
Chilled water supply & return & dual temp piping	CG	38	38	38	51	51	51
	~~FC~~	~~13~~	~~25~~	~~25~~	~~25~~	~~25~~	~~25~~
	PF	13	25	25	25	25	25
Cold domestic water, above and below ceilings	CG	38	38	38	38	38	38
	~~FC~~	~~10~~	~~10~~	~~10~~	~~10~~	~~10~~	~~10~~
	PF	10	10	10	10	10	10
Exposed lavatory drains exposed domestic water piping & drains to areas for handicap personnel	~~FC~~	~~13~~	~~13~~	~~13~~	~~13~~	~~19~~	~~19~~
Horizontal roof drain leaders (including underside of roof drain fitting)	~~FC~~		~~25~~	~~38~~	~~38~~	~~38~~	~~38~~
	PF		13	13	13	13	13
	CG		38	38	38	38	38
Vertical roof drain leaders leaders	~~FC~~		~~25~~	~~25~~	~~38~~	~~38~~	~~38~~
	PF		13	13	13	13	13
	CG		38	38	38	38	38
Air conditioning condensate drain located inside building	~~FC~~		~~10~~	~~13~~	~~13~~	~~N/A~~	~~N/A~~
	PF		10	10	10	N/A	N/A

*When runouts to terminal units exceed 3.66 m the entire length of runout shall be insulated like the main feed pipe.

LEGEND:

PF - Phenolic Foam
CG - Cellular Glass
[AM#2] ~~FC - Flexible Cellular~~

3.2.2.2 Jacket for Fibrous, Cellular Glass, and Phenolic Foam Insulated Pipe

Insulation shall be covered with a factory applied vapor retarder jacket or field applied seal welded PVC jacket. Insulation inside the building shown to be protected with an aluminum jacket shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets shall be utilized. Pipe insulation to the 1.5 m level will be protected.

3.2.2.3 Insulation for Straight Runs (Fibrous, Cellular Glass and Phenolic Foam)

a. Insulation shall be applied to the pipe with joints tightly butted. The ends of fibrous insulation shall be sealed off with vapor retarder coating at intervals not to exceed 4.5 m.

b. Longitudinal laps of the jacket material shall overlap not less than 38 mm. Butt strips 75 mm wide shall be provided for circumferential joints.

c. Laps and butt strips shall be secured with adhesive and stapled on 100 mm centers if not factory self-sealing.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 4 degrees C and 50 degrees C during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating.

f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it with adhesive, stapling, and coating with vapor retarder coating. The patch shall extend not less than 38 mm past the break.

g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating.

3.2.2.4 Insulation for Fittings and Accessories

a. Pipe insulation shall have ends thoroughly coated with a vapor retarder coating not less than 150 mm from each flange, union, valve, anchor, or fitting in all directions.

b. Precut, preformed insulation for placement over fittings, flanges, unions, valves, anchors, and mechanical couplings shall be used. Precut, preformed insulation shall exhibit the same properties as the adjoining pipe insulation. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation should be overlapped 50 mm or one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Elbows insulated using segments shall not have less than 3 segments per elbow.

c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with two coats of vapor retarder coating with a minimum total thickness of 1.6 mm, applied with glass tape embedded between coats. Tape seams shall overlap 25 mm. The coating shall extend out onto the adjoining pipe insulation 50 mm.

d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 150 mm

f. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same thickness as adjoining pipe insulation and the insulation shall be protected with one coat of vapor retarder coating under the PVC cover. The covers shall be secured by PVC vapor retarder tape, adhesive, seal-welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

For hot pipelines above 16 degrees C the following shall be included:

a. Domestic hot water.

d. Hot water heating.

3.2.3.1 Insulation Thickness

Table A

Thickness of Pipe Insulation for Pipes Handling Steam and Fluids Other Than Domestic Hot Water (mm)

Fluid Temperature Range (C)	Insulation Conductivity: Conductivity Range W/(mK)	Mean Rating Temperature C	Runouts* up to 51	Nominal Pipe Diameter (mm): 25 & less	32 to 51	64 to 102	127 to 152	203 & lgr
above 177	0.046 - 0.049	121	38	64	64	76	89	89
122 - 177	0.042 - 0.045	93	38	51	64	64	89	89
94 - 121	0.039 - 0.043	66	25	38	38	51	51	89
61 - 93	0.036 - 0.042	52	13	38	38	38	38	38
41 - 60	0.035 - 0.040	38	13	25	25	25	38	38
	Domestic and Service Hot Water System							
> 41	0.035 - 0.040	38	13	25	25	38	38	38

* When runouts to terminal units exceed 3.66 m, the entire length of runout shall be insulated like the main feed pipe.

LEGEND:

PF - Phenolic Foam
CG - Cellular Glass
FC - Flexible Cellular

Table II - Hot Piping Insulation Thickness
Pipe Size (mm)

Type of Service (degrees C)	Material	Runouts up to 51 mm	25 mm & less	32 - 51 mm	64 - 102 mm	127 - 152 mm	203 mm & larger
Hot domestic water supply & recirculating system (93.3 C max)	CG	38	38	38	38	38	38
	FC	13	25	25	38	38	38
	PF	13	25	25	25	25	25
	MF	13	25	25	38	38	38
Heating hot water, supply & return (121.1	CG	38	38	51	51	51	64
	PF	13	25	25	25	25	38
	MF	13	38	38	51	64	76

C max)	CS	25	38	51	64	64	64

*When runouts to terminal units exceed 3.66 m, the entire length of runout shall be insulated like the main feed pipe.

3.2.3.2 Jacket for Insulated Pipe

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type II jacket or field applied aluminum where required or seal welded PVC.

3.2.3.3 Insulation for Straight Runs

a. Insulation shall be applied to the pipe with joints tightly butted.

b. Longitudinal laps of the jacket material shall overlap not less than 38 mm, and butt strips 75 mm wide shall be provided for circumferential joints.

c. Laps and butt strips shall be secured with adhesive and stapled on 100 mm centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed.

d. Factory self-sealing lap systems may be used when the ambient temperature is between 4 degrees C and 49 degrees C and shall be installed in accordance with manufacturer's instructions. Laps and butt strips shall be stapled whenever there is nonadhesion of the system. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.

e. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and be secured with adhesive and stapled on 100 mm centers if not factory self-sealing. Adhesive may be omitted where pipe is concealed. Patch shall extend not less than 38 mm past the break.

f. Install flexible cellular pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or tubing. All seams and butt joints shall be secured and sealed with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives must be used. Type II sheet insulation when used on pipe larger than 150 mm shall not be stretched around the pipe. On pipes larger than 300 mm, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

3.2.3.4 Insulation for Fittings and Accessories

a. The run of the line pipe insulation shall have the ends brought up to the item.

b. Insulation of the same thickness and conductivity as the adjoining pipe insulation, either premolded or segmented, shall be placed around the item abutting the adjoining pipe insulation, or if nesting size insulation is used, overlapping 50 mm or one pipe diameter. Loose fill mineral fiber or insulating cement shall be used to fill the voids. Insulation for elbows less than 80 mm size shall be premolded. Insulation for elbows 80 mm size and larger shall be either premolded or segmented. Elbows insulated using segments shall have not less than 3 segments per elbow. Insulation may be wired or taped on until finish is applied.

c. Upon completion of installation of insulation on flanges, unions, valves, anchors, fittings and accessories, terminations and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with two coats of Class 1 adhesive applied with glass tape embedded between coats. Tape seams shall overlap 25 mm. Adhesive shall extend onto the adjoining insulation not less than 50 mm. The total dry film thickness shall be not less than 1.6 mm

d. Insulation terminations shall be tapered to unions at a 45-degree angle.

e. At the option of the Contractor, factory premolded one- or two-piece PVC fitting covers may be used in lieu of the adhesive and embedded glass tape. Factory premolded segments or factory or field cut blanket insert insulation segments shall be used under the cover and shall be the same thickness as adjoining pipe insulation. The covers shall be secured by PVC vapor retarder tape, adhesive, seal-welding or with tacks made for securing PVC covers.

3.2.4 Piping Exposed to Weather

Piping exposed to weather, including piping in crawl space, shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, an aluminum jacket shall be applied. PVC jacketing requires no factory applied jacket beneath it. Flexible cellular insulation exposed to weather shall be treated in accordance with paragraph FLEXIBLE CELLULAR INSULATION.

3.2.4.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 50 mm at longitudinal and circumferential joints and shall be secured with bands at not more than 300 mm centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 16 degrees C and below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 16 degrees C and below abuts an uninsulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 16 degrees C shall be sealed with a moisture retarder.

3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of an emulsion type weatherproof mastic recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be

not less than 25 mm and the adjoining aluminum jacket not less than 50 mm. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be used with PVC lagging and adhesive welded moisture tight.

3.2.4.3 PVC Lagging

PVC lagging shall be ultraviolet resistant and adhesive welded vapor tight with manufacturer's recommended adhesive. Installation shall include provision for thermal expansion.

3.2.5 Below ground Pipe Insulation

The following shall be included:

a. Chilled cooling water.

3.2.5.1 Type of Insulation

Below ground pipe shall be insulated with 75 mm cellular glass insulation set in a coat of bedding compound as recommended by the manufacturer.

3.2.5.2 Installation of Below ground Pipe Insulation

a. Bore surfaces of the insulation shall be coated with a thin coat of gypsum cement of a type recommended by the insulation manufacturer. Coating thickness shall be sufficient to fill surface cells of insulation. Mastic type materials shall not be permitted for this coating.

b. Insulation applied to the pipe shall have joints tightly butted and bedded together with bedding compound as recommended by the manufacturer. Butt joints shall be staggered.

c. Stainless steel bands, 19 mm wide by 0.5080 mm thick shall be used to secure insulation in place. A minimum of two bands per section of insulation shall be applied. As an alternate, fiberglass reinforced tape may be used to secure insulation on piping up to 300 mm in diameter. A minimum of two bands per section of insulation shall be applied.

d. Insulation shall terminate at anchor blocks but shall be continuous through sleeves and manholes.

e. At point of entry to buildings, underground insulation shall be terminated 50 mm inside the wall or floor, shall butt tightly against the aboveground insulation and the butt joint shall be sealed with vapor retarder coating.

f. Provision for expansion and contraction shall be made in accordance with the insulation manufacturer's recommendations.

g. Flanges, couplings, valves, and fittings shall be insulated with factory premolded, prefabricated, or field-fabricated sections of insulation of the same material and thickness as the adjoining pipe insulation. Insulation sections shall be secured in place with wire, bore surfaces coated, and joints sealed as specified.

h. Insulation, including fittings, shall be finished with three coats of asphaltic mastic, with 10 by 10 glass mesh reinforcing fabric embedded between coats. Fabric shall be overlapped a minimum of 50 mm at joints. Total film thickness shall be a minimum of 4.7 mm. As an alternate, a prefabricated bituminous laminated jacket, reinforced with 10 by 10-glass fiber mesh, shall be applied to the insulation. Jacketing material and application procedures shall match manufacturer's written instructions.

i. At termination points, other than building entrances, the mastic and cloth or tape shall cover the ends of insulation and extend 50 mm along the bare pipe.

3.3 DUCT INSULATION INSTALLATION

| [AM#2] Except for oven hood exhaust duct insulation, corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket. ~~Duct insulation shall be omitted on exposed supply and return ducts in air conditioned spaces unless otherwise shown.~~ Air conditioned spaces shall be defined as those spaces directly supplied with cooled conditioned air (or provided with a cooling device such as a fan-coil unit) and heated conditioned air (or provided with a heating device such as a unit heater, radiator or convector).

3.3.1 Duct Insulation Thickness

Duct insulation thickness shall be in accordance with Table III.

Table III - Minimum Duct Insulation (mm)

Cold Air Ducts	50
Relief Ducts	50
Fresh Air Intake Ducts	50
Warm Air Ducts	50
Relief Ducts	50
Fresh Air Intake Ducts	50

3.3.2 Insulation and Vapor Retarder for Cold Air Duct

Insulation and vapor retarder for cold air duct below 16 degrees C: Ducts and associated equipment shall be insulated to a thickness which is in accordance with Table III. The following shall be insulated:

a. Supply ducts.

b. Return air ducts.

c. Relief ducts.

d. Flexible runouts (field-insulated).

e. Plenums.

f. Duct-mounted coil casings.

g. Coil headers and return bends.

h. Coil casings.

I. Fresh air intake ducts.

j. Filter boxes.

k. Mixing boxes (field-insulated).

l. Supply fans (field-insulated).

m. All tops of diffusers.

n. All linear diffuser plenums.

o. Combustion air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 12 kg per cubic meter and rigid type where exposed, minimum density 48 kg per cubic meter. Insulation for round/oval ducts shall be flexible type, minimum density 12 kg per cubic meter with a factory Type I jacket; or, a semi rigid board, minimum density 48 kg per cubic meter, formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered, with a factory applied Type I all service jacket. Insulation for exposed ducts shall be provided with either a white, paintable, factory-applied Type I jacket or a vapor retarder jacket coating finish as specified. Fibrous and cellular glass insulation on concealed duct shall be provided with a factory-applied Type I vapor retarder jacket. The total dry film thickness shall be approximately 1.6 mm. Duct insulation shall be continuous through sleeves and prepared openings except fire wall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder shall cover the collar, neck, and any uninsulated surfaces of diffusers, registers and grills. Vapor retarder materials shall be applied to form a complete unbroken vapor seal over the insulation.

3.3.2.1 Installation on Concealed Duct

a. For rectangular, oval or round ducts, insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 150 mm wide strips on 300 mm centers.

b. For rectangular and oval ducts, 600 mm and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corners.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corners.

d. Insulation shall be impaled on the mechanical fasteners where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder jacket joints overlap 50 mm. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used. The pin shall be trimmed back and bent over.

f. Jacket overlaps shall be secured under the overlap with Class 2 adhesive and stapled on 100 mm centers. Staples and seams shall be coated with a brush coat of vapor retarder coating.

g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder. The patches shall extend not less than 50 mm beyond the break or penetration in all directions and shall be secured with Class 2 adhesive and staples. Staples and joints shall be sealed with a brush coat of vapor retarder coating.

| h. [AM#2] At jacket penetrations such as hangers thermometers and damper operating rods, voids in the insulation shall be filled and the
| penetration sealed with a brush coat of vapor retarder coating. Vapor
| retarder shall extend a minimum of 8" up the hanger.

i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 50 mm. Pin puncture coatings shall extend 50 mm from the puncture in all directions.

j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.3.2.2 Installation on Exposed Duct Work

a. For rectangular ducts, rigid insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 300 mm apart and not more than 75 mm from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 300 mm and larger. One row shall be provided for each side of duct less than 300 mm.

b. Duct insulation shall be formed with minimum jacket seams. Each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projections is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor retarder jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and the pin trimmed and bent over.

d. Joints in the insulation jacket shall be sealed with a 100 mm wide strip of the same material as the vapor retarder jacket. The strip shall be secured with Class 2 adhesive and stapled. Staples and seams shall be sealed with a brush coat of vapor retarder coating.

| e. [AM#2] Breaks and ribs or standing seam penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 50 mm beyond the break or penetration and shall be secured with Class 2 adhesive and stapled. Staples and joints shall be sealed with a brush coat of vapor retarder
| coating. Vapor retarder shall extend a minimum of 8 inches up hangers.

f. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a brush coat of vapor retarder coating.

g. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and uninsulated surface 50 mm. Pin puncture coatings shall extend 50 mm from the puncture in all directions.

h. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation with minimum density of 12 kg per cubic meter attached by applying Class 2 adhesive around the entire perimeter of the duct in 150 mm wide stripe on 300 mm centers.

3.3.3 Insulation for Warm Air Duct

For warm air ducts above 16 degrees C, ducts and associated equipment shall be insulated to a thickness which is in accordance with Table III. The following shall be insulated:

a. Supply ducts.

b. Return air ducts.

c. Relief air ducts.

d. Flexible runouts (field insulated).

e. Plenums.

f. Duct-mounted coil casings.

g. Coil-headers and return bends.

h. Coil casings.

I. Fresh air intake ducts.

j. Filter boxes.

k. Mixing boxes.

l. Supply fans.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 12 kg per cubic meter; and rigid type where exposed, minimum density 48 kg per cubic meter. Insulation on exposed ducts shall be provided with a white, paintable, factory-applied Type II jacket, or finished with Class 1 adhesive finish. Flexible type insulation shall be used for round ducts, minimum density 12 kg per cubic meter with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Class 1 adhesive finish where indicated to be used shall be accomplished by applying two coats of Class 1 adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1.6 mm. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

a. For rectangular, oval and round ducts, insulation shall be attached by applying Class 2 adhesive around the entire perimeter of the duct in 150 mm wide strips on 300 mm centers.

b. For rectangular and oval ducts 600 mm and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corner.

c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 450 mm centers and not more than 450 mm from duct corners.

d. The insulation shall be impaled on the mechanical fasteners where used and shall be pressed thoroughly into the adhesive. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.

e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.

f. Insulation jacket shall overlap not less than 50 mm at joints and the lap shall be secured with Class 2 adhesive under the lap and stapled on 100 mm centers.

3.3.4 Ducts Handling Air for Dual Purpose

For air handling ducts for dual purpose below and above 16 degrees C, ducts shall be insulated as specified for cold air duct.

3.3.5 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

3.4 EQUIPMENT INSULATION INSTALLATION

3.4.1 General

Removable insulation sections shall be provided to cover parts of equipment which must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

a. Handholes.

b. Boiler manholes.

c. Cleanouts.

d. ASME stamps.

e. Manufacturer's nameplates.

3.4.2 Insulation for Cold Equipment

Cold equipment below 16 degrees C: Insulation shall be furnished on equipment handling media below 16 degrees C including the following:

a. Pumps.

b. Refrigeration equipment parts that are not factory insulated.

c. Drip pans under chilled equipment.

d. Cold water storage tanks.

e. Water softeners.

f. Duct mounted coils.

g. Cold and chilled water pumps.

I. Roof drain bodies.

j. Air handling equipment parts that are not factory insulated.

k. Expansion and air separation tanks.

3.4.2.1 Insulation Type

Insulation shall be suitable for the temperature encountered. Thicknesses shall be as follows:

a. Equipment Handling Media Between 2 and 16 degrees C: 50 mm thick cellular glass, 38 mm thick flexible cellular, or 25 mm thick phenolic foam.

b. Equipment Handling Media Between minus 18 degrees C and plus 1 degrees C: 90 mm thick cellular glass, 63.5 mm flexible cellular, or 38 mm thick phenolic foam.

c. Equipment Handling Media Between minus 34 degrees C and minus 18 degrees C: 100 mm thick cellular glass 75 mm thick flexible cellular, or 38 mm thick phenolic foam.

3.4.2.2 Pump Insulation

a. Pumps shall be insulated by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints which do not leave raw ends of insulation exposed. Joints between sides and between sides and bottom shall be joined by adhesive with lap strips for rigid mineral fiber and contact adhesive for flexible cellular insulation. The box shall conform to the requirements of \-MICA-01-\ plate No. 49 when using flexible cellular insulation. Joints between top cover and sides shall fit tightly forming a female shiplap joint on the side pieces and a male joint on the top cover, thus making the top cover removable.

b. Exposed insulation corners shall be protected with corner angles.

c. Upon completion of installation of the insulation, including removable sections, two coats of vapor retarder coating shall be applied with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1.6 mm. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. Caulking shall be applied to parting line, between equipment and removable section insulation, and at all penetrations.

3.4.2.3 Other Equipment

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not more than 300 mm centers except flexible cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.

c. Cellular glass and phenolic foam insulation shall be set in a coating of bedding compound, and joints shall be sealed with bedding compound as recommended by the manufacturer. Mineral fiber insulation joints shall be filled with finishing cement.

d. Insulation on heads of heat exchangers shall be removable. Removable section joints shall be fabricated using a male-female shiplap type

joint. The entire surface of the removable section shall be finished by applying two coats of vapor retarder coating with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1.6 mm.

e. Exposed insulation corners shall be protected with corner angles.

f. Insulation on equipment with ribs shall be applied over 150 by 150 mm by 2.6 mm welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 50 by 50 mm washers or shall be securely banded or wired in place on 300 mm centers.

3.4.2.4 Vapor Retarder

Upon completion of installation of insulation, penetrations shall be caulked. Two coats of vapor retarder coating shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1.6 mm. Caulking shall be applied to parting line between equipment and removable section insulation.

3.4.3 Insulation for Hot Equipment

Hot equipment above 16 degrees C: Insulation shall be furnished on equipment handling media above 16 degrees C including the following:

a. Water heaters.

b. Pumps handling media above 54 degrees C.

c. Hot water storage tanks.

d. Air separation tanks.

e. Unjacketed boilers or parts of boilers.

f. Boiler flue gas connection from boiler to stack (if inside).

3.4.3.1 Insulation of Pumps

Pumps shall be insulated by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints which do not leave raw ends of insulation exposed. Bottom and sides shall be banded to form a rigid housing which does not rest on the pump. Joints between top cover and sides shall fit tightly. The top cover shall have a joint forming a female shiplap joint on the side pieces and a male joint on the top cover, thus making the top cover removable. Two coats of Class I adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. The total dry thickness of the finish shall be 1.6 mm. Caulking shall be applied to parting line of the removable sections and penetrations.

3.4.3.2 Other Equipment

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not greater than 300 mm centers except flexible cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.

c. On high vibration equipment, cellular glass insulation shall be set in a coating of bedding compound as recommended by the manufacturer, and joints shall be sealed with bedding compound. Mineral fiber joints shall be filled with finishing cement.

d. Insulation on heads of heat exchangers shall be removable. The removable section joint shall be fabricated using a male-female shiplap type joint. Entire surface of the removable section shall be finished as specified.

e. Exposed insulation corners shall be protected with corner angles.

f. On equipment with ribs such as boiler flue gas connection, draft fans, and fly ash or soot collectors, insulation shall be applied over 150 by 150 mm by 2.6 mm welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 50 by 50 mm washers or shall be securely banded or wired in place on 300 mm (maximum) centers.

3.4.4 Equipment Handling Dual Temperature Media

Below and above 16 degrees C: Equipment handling dual temperature media shall be insulated as specified for cold equipment.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 15330

WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION

PART 1 - GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 47-\	(1990) Ferritic Malleable Iron Castings
\-ASTM A 53-\	(1993) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
\-ASTM A 135-\	(1993) Electric-Resistance-Welded Steel Pipe
\-ASTM A 183-\	(1983; R 1990) Carbon Steel Tract Bolts and Nuts
\-ASTM A 536-\	(1984; R 1993) Ductile Iron Castings
\-ASTM A 795-\	(1993) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

\-ASME B16.1-\	(1989) Cast Iron Pipe Flanges and Flanged Fittings
\-ASME B16.3-\	(1992) Malleable Iron Threaded Fittings
\-ASME B16.4-\	(1992) Cast Iron Threaded Fittings
\-ASME B16.9-\	(1993) Factory-Made Wrought Steel Buttwelding Fittings
\-ASME B16.11-\	(1991) Forged Fittings, Socket-Welding and Threaded
\-ASME B16.21-\	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
\-ASME B18.2.1-\	(1981; R 1992) Square and Hex Bolts and Screws (Inch Series)
\-ASME B18.2.2-\	(1987; R 1993) Square and Hex Nuts (Inch Series)

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

\-ASSE 1015-\	(1993) Double Check Backflow Prevention Assembly

AMERICAN WATER WORKS ASSOCIATION (AWWA)

\-AWWA-01-\	(1992) Standard Methods for the Examination of Water and Wastewater
\-AWWA B300-\	(1992) Hypochlorites
\-AWWA B301-\	(1992) Liquid Chlorine
\-AWWA C104-\	(1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
\-AWWA C110-\	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In., for Water and Other Liquids
\-AWWA C111-\	(1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
\-AWWA C151-\	(1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
\-AWWA C203-\	(1991) Coal-tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
\-AWWA M20-\	(1973) Manual: Water Chlorination Principles and Practices

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

\-FM P7825-\	(1996; Supple 1) Approval Guide

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

\-MSS SP-71-\	(1990) Cast Iron Swing Check Valves, Flanges and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 13-\	(1996) Installation of Sprinkler Systems
\-NFPA 24-\	(1995) Installation of Private Fire Service Mains and Their Appurtenances
\-TM 5-813-5/AFM 88-10-\	"Water Supply, Water Distribution"

UNDERWRITERS LABORATORIES (UL)

\-UL-01-\	(1996) Building Materials Directory

\-UL-04-\ (1996) Fire Protection Equipment Directory

1.2 GENERAL REQUIREMENTS

Wet pipe sprinkler system shall be provided throughout except in crawl space. The sprinkler system shall provide fire sprinkler protection for the entire area. Except as modified herein, the system shall be designed and installed in accordance with \-NFPA 13-\. Pipe sizes shall be determined by hydraulic calculation.

1.2.1 Hydraulic Design

The system shall be hydraulically designed for Light Hazard to discharge a minimum density of 4.07 L/min per square meter over the hydraulically most demanding 278 square meters of floor area. The minimum pipe size for branch lines in gridded systems shall be 32 mm. Hydraulic calculations shall be in accordance with the Area/Density Method of \-NFPA 13-\. Ordinary Hazard 1 density shall be provided in selected areas as shown on the drawings based on 6.11 L/min per square meter over 278 square meters.

1.2.1.1 Hose Demand

An allowance for exterior hose streams of 946 L/min shall be added to the sprinkler system demand at the point of connection to the existing water supply system.

1.2.1.2 Basis for Calculations

The design of the system shall be based upon a water supply with a static pressure of 4.8 bars, and a flow of 3,917 L/min at a residual pressure of 2.8 bars. Water supply shall be presumed available at the point of connection to existing supply at the street. The contractor shall verify water supply. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, and 140 for new cement-lined ductile-iron piping.

1.2.2 Sprinkler Spacing

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler for Light hazard shall not exceed 20.9 square meters. And other limits specified in \-NFPA 13-\ for light hazard occupancy. Ordinary Hazard 1 sprinklers shall not exceed 12 square meters.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. Submittals related to system configuration, hydraulic calculations, and equipment selection, including manufacturer's catalog data, working drawings, connection drawings, control diagrams and certificates shall be submitted concurrently as a complete package. The package will be reviewed by the U.S. Army Engineer District Fire Protection Engineer. The following shall be submitted in accordance with Section \=01300=\ SUBMITTAL DESCRIPTIONS:

SD-01 Data\

Sprinkler System Equipment\; *GA*\

Manufacturer's Catalog Data for each separate piece of equipment proposed for use in the system. Data shall indicate the name of the manufacturer of each item of equipment, with data highlighted to indicate model, size, options, etc. proposed for installation. In addition, a complete equipment list which includes equipment description, model number and quantity shall be provided.

Hydraulic Calculations\; *GA*\

Hydraulic calculations, including a drawing showing hydraulic reference points and pipe segments

Spare Parts\; *GA*\

Spare parts data shall be included for each different item of material and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. A list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor shall be included.

SD-04 Drawings\

Sprinkler System Shop Drawings\; *GA*\

Detail drawings conforming to the requirements established for working plans as prescribed in \-NFPA 13-\. Drawings shall include plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance. Each set of drawings shall include the following:

a. Descriptive index of drawings in the submittal with drawings listed in sequence by drawing number. A legend identifying device symbols, nomenclature, and conventions used.

b. Floor plans drawn to a scale not less than 1:100 which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

d. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

e. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

As-Built Drawings\; *FIO*\

As-built drawings, no later than 14 working days after completion of the Final Tests. The sprinkler system shop drawings shall be updated to reflect as-built conditions after work is completed and shall be on reproducible full-size mylar film.

SD-06 Instructions\

Test Procedures\; *GA*\

Proposed test procedures for piping hydrostatic test, testing of alarms, at least 14 days prior to the start of related testing.

SD-07 Schedules\

Preliminary Tests\; *GA*\

A schedule of preliminary tests, at least 14 days prior to the proposed start of the tests.

Final Test\; *GA*\

Upon successful completion of tests specified under PRELIMINARY TESTS, written notification shall be given to the Contracting Officer of the date for the final acceptance test. Notification shall be provided at least 14 days prior to the proposed start of the test. Notification shall include a copy of the Contractor's Material & Test Certificates.

SD-08 Statements\

Submittal Preparer's Qualifications\; *GA*\.

Qualifications of the submittal preparer.

Installer Qualifications\; *GA*\.

Qualifications of the sprinkler installer.

SD-13 Certificates\; *GA*\

Contractor's Material & Test Certificates. Certificates, as specified in \-NFPA 13-\, shall be completed and signed by the Contractor's Representative performing required tests for both underground and aboveground piping.

SD-19 Operation and Maintenance Manuals\

Sprinkler System\; *GA*\

Manuals shall be in loose-leaf binder format and grouped by technical sections consisting of manufacturer's standard brochures, schematics,

printed instructions, general operating procedures, and safety precautions. The manuals shall list routine maintenance procedures possible breakdowns, and repairs, and troubleshooting guide. This shall include procedures and instructions pertaining to frequency of preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

Qualifications\; *GA*\

Qualifications, with verification of experience and license number, of a Registered Professional Engineer with at least 5 years of current experience in the design of the fire protection and detection systems. This engineer must perform the various specification items required by this section to be performed by a registered Professional Engineer.

1.4 HYDRAULIC CALCULATIONS

Hydraulic calculations shall be as outlined in \-NFPA 13-\ except that calculations shall be performed by computer using software specifically designed for fire protection system design. Software which uses k-factors for typical branch lines is not acceptable. Calculations shall be taken back to the water supply source unless water supply data is otherwise indicated. Calculations shall substantiate that the design area indicated is the hydraulically most demanding. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be independent of shop drawings.

1.5 SUBMITTAL PREPARER'S QUALIFICATIONS

The sprinkler system submittals, including as-built drawings, shall be prepared by an individual who is either a registered professional engineer or who is certified as a Level IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014.

1.6 INSTALLER QUALIFICATIONS

The installer shall be experienced and regularly engaged in the installation of the type and complexity of system included in this project. A statement prior to submittal of any other data or drawings, that the proposed sprinkler system installer is regularly engaged in the installation of the type and complexity of system included in this project shall be provided. In addition, data identifying the location of at least three systems

recently installed by the proposed installer which are comparable to the system specified shall be submitted. Contractor shall certify that each system has performed satisfactorily, in the manner intended, for a period of not less than 6 months.

1.7 REGULATORY REQUIREMENTS

Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears. Applicable material and installation standards referenced in Appendix A of \-NFPA 13-\ and \-NFPA 24-\ shall be considered mandatory the same as if such referenced standards were specifically listed in this specification. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification shall govern. All requirements that exceed the minimum requirements of \-NFPA 13-\ shall be incorporated into the design. Reference to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

1.8 DELIVERY AND STORAGE

Equipment placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust or other contaminants.

PART 2 - PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.1.2 Requirements for Fire Protection Service

Equipment and materials shall have been tested by Underwriters Laboratories, Inc. and listed in \-UL-04-\ or approved by Factory Mutual and listed in \-FM P7825-\. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in \-UL-04-\ or \-FM P7825-\.

2.1.3 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate permanently affixed to the item of equipment.

2.2 UNDERGROUND PIPING SYSTEMS

2.2.1 Pipe

Piping from a point 150 mm above the floor to a point 1500 mm outside the building wall shall be ductile iron with a rated working pressure of 12 bars conforming to \-AWWA C151-\, with cement mortar lining conforming to \-AWWA

C104-\. Piping more than 1500 mm outside the building walls shall comply with Section \=02660=\ WATER LINES.

2.2.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to \-AWWA C110-\. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to \-AWWA C111-\.

2.3 Aboveground piping shall be steel

2.3.1 Steel Piping System

2.3.1.1 Steel Pipe

Except as modified herein, steel pipe shall be schedule 40 galvanized as permitted by \-NFPA 13-\ and shall conform to applicable provisions of \-ASTM A 795-\, \-ASTM A 53-\, or \-ASTM A 135-\. Pipe in which threads or grooves are cut shall be Schedule 40 galvanized. Pipe shall be marked with the name of the manufacturer, kind of pipe, and ASTM designation.

2.3.1.2 Fittings for Non-Grooved Steel Pipe

Fittings shall be cast iron conforming to \-ASME B16.4-\, steel conforming to \-ASME B16.9-\ or \-ASME B16.11-\, or malleable iron conforming to \-ASME B16.3-\. Steel press fittings shall be approved for fire protection systems. Galvanized fittings shall be used for piping systems or portions of piping systems utilizing galvanized piping. Fittings into which sprinklers, drop nipples or riser nipples (sprigs) are screwed shall be threaded type. Plain-end fittings with mechanical couplings, fittings which use steel gripping devices to bite into the pipe and segmented welded fittings shall not be used. Minimum branch line fitting shall be 25.3 mm, provide 25.3 mm by 13 mm for sprinkler head connections on branch lines.

2.3.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to \-ASTM A 47-\, Grade 32510; ductile iron conforming to \-ASTM A 536-\, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to \-ASTM A 183-\ and shall be cadmium plated or zinc electroplated. Minimum branch line fitting shall be 25.3 mm, provide 25.3 mm by 13 mm for sprinkler head connections on branch lines.

2.3.1.4 Flanges

Flanges shall conform to \-NFPA 13-\ and \-ASME B16.1-\. Gaskets shall be non-asbestos compressed material in accordance with \-ASME B16.21-\, 1.6 mm thick, and full face or self-centering flat ring type. Bolts shall be squarehead conforming to \-ASME B18.2.1-\ and nuts shall be hexagon type conforming to \-ASME B18.2.2-\.

2.3.2 Pipe Hangers

| [AM#2]Hangers shall be listed in \-UL-04-\ or \-FM P7825-\ and of the type suitable for the application, construction, and pipe type and sized
| involved. Pipe hangers shall be G90 galvanized along with all hanger
| accessories.

2.3.3 Valves

2.3.3.1 Control Valve and Gate Valve

Manually operated sprinkler control valve and gate valve shall be outside stem and yoke (OS&Y) type and shall be listed in -\UL-01-\ or \-FM P7825-\.

Check valve 50 mm and larger shall be listed in \-UL-01-\ or \-FM P7825-\. Check valves 100 mm and larger shall be of the swing type with flanged cast iron body and flanged inspection plates, shall have a clear waterway and shall meet the requirements of \-MSS SP-71-\, for Type 3 or 4.

2.4 ALARM INITIATING AND SUPERVISORY DEVICES

2.4.1 Sprinkler Waterflow Indicator Switch, Vane Type

Switch shall be vane type with a pipe saddle and cast aluminum housing. The electro-mechanical device shall include a flexible, low-density polyethylene paddle conforming to the inside diameter of the fire protection pipe. The device shall sense water movements and be capable of detecting a sustained flow of 38 L/min or greater. The device shall contain a retard device adjustable from 0 to 90 seconds to reduce the possibility of false alarms caused by transient flow surges. The switch shall include two SPDT (Form C) contacts, and shall be equipped with a silicone rubber gasket to assure positive water seal and a dustproof cover and gasket to seal the mechanism from dirt and moisture. These switched are to be wired by the fire alarm contractor. Coordinate compatibility with fire alarm contractor.

2.4.2 Valve Supervisory (Tamper) Switch

Switch shall be suitable for mounting to the type of control valve to be supervised open. The switch shall be tamper resistant and contain one set of SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem/wheel.

2.4.3 Electric Alarm Bell Assembly (Outdoor)

Assembly shall include matching weatherproof backbox, be of the vibrating type suitable for outdoor use. Bells shall produce a minimum sound rating of at least 85 dBA at 3 m. Bells shall be powered from the fire alarm control panel. Coordinate compatibility with fire alarm contractor.

2.5 FIRE DEPARTMENT CONNECTION

Fire department connection shall be projecting type with cast brass body, matching wall escutcheon lettered "Auto Spkr" with a polished brass finish. The connection shall have two inlets with individual self-closing clappers, caps with drip drains and chains. Female inlets shall have 65 mm diameter American National Fire Hose Connection Screw Threads (NH) per NFPA 1963.

2.6 SPRINKLERS

Sprinklers shall be quick response and used in accordance with their listed spacing limitations. Temperature classification shall be ordinary. Sprinklers in high heat areas including in close proximity to unit heaters shall have temperature classification in accordance with \-NFPA 13-\.

2.6.1 Upright Sprinkler

Upright sprinkler shall be brass fusible strut or glass bulb type in mechanical and electrical rooms, chrome in the high ceiling areas of waiting areas, and shall have a nominal 12.7 mm orifice. Viking Model M or Central GBQR or equivalent.

2.6.2 Pendent Sprinkler

Pendent sprinkler shall be of the fusible strut or glass bulb type, with nominal 12.7 mm orifice. Pendent sprinklers shall have a polished chrome finish, these are generally located throughout the building, except pendent sprinklers in radiographic rooms shall be recessed. Viking Model M or Central GBQR or equivalent.

2.7 DISINFECTING MATERIALS

2.7.1 Liquid Chlorine - Liquid chlorine shall conform to \-AWWA B301-\.

2.7.2 Calcium hypochlorite and sodium hypochlorite shall conform to \-AWWA B300-\.

2.8 ACCESSORIES

2.8.1 Sprinkler Cabinet

Spare sprinklers shall be provided in accordance with \-NFPA 13-\ and shall be packed in a suitable metal or plastic cabinet. Spare sprinklers shall be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed. At least one wrench of each type required shall be provided.

2.8.2 Pendent Sprinkler Escutcheon

Escutcheon shall be one-piece metallic type with a depth of less than 20 mm and suitable for installation on pendent sprinklers. The escutcheon shall have a factory finish that matches the pendent sprinkler heads.

2.8.3 Pipe Escutcheon

Escutcheon shall be polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or set screw

2.8.4 Sprinkler Guard

Guard shall be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards shall be provided on sprinklers located in mechanical rooms or similar areas subject to mechanical damage or when heads are located less than 2.1 meters above the floor.

2.8.5 Identification Sign

Valve identification sign shall be minimum 150 mm wide x 50 mm high with enamel baked finish on minimum 1.214 mm steel or 0.6 mm aluminum with red letters on a white background or white letters on red background. Wording of sign shall include, but not be limited to "main drain," "auxiliary drain," "inspector's test," "alarm test," "alarm line," and similar wording as required to identify operational components.

2.9 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLY

2.9.1 Double-check backflow prevention

Assembly shall comply with \-ASSE 1015-\. The assembly shall have a bronze, cast-iron or stainless steel body with flanged ends. The assembly shall include OS&Y shutoff valves on the inlet and outlet, 2-positive-seating check valve for continuous pressure application, and four test cocks. Assemblies shall be rated for working pressure of 12.1 bars. The maximum pressure loss shall be 40 kPa at a flow rate equal to the sprinkler water demand, at the location of the assembly.

2.9.2 Backflow preventer shall have a full size bypass with valve chained closed.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

The installation shall be in accordance with the applicable provisions of \-NFPA 13-\, \-NFPA 24-\ and publications referenced therein.

3.2 ABOVEGROUND PIPING INSTALLATION

Piping shall be run straight and bear evenly on hangers and supports.

3.2.1 Piping in Exposed Areas

Exposed piping shall be installed so as not to diminish exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, shall be installed to provide maximum headroom.

3.2.2 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping shall be concealed above ceilings. Piping shall be inspected, tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas shall be concealed.

3.2.3 Pendent Sprinklers

Drop nipples to pendent sprinklers shall consist of minimum 25 mm pipe with a reducing coupling into which the sprinkler shall be threaded. Hangers shall be provided on arm-overs to drop nipples supplying pendent sprinklers when the arm-over exceeds 300 mm. Where sprinklers are installed below suspended or dropped ceilings, drop nipples shall be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished

space. The outlet of the reducing coupling shall not extend more than 25 mm below the underside of the ceiling. On pendent sprinklers installed below suspended or dropped ceilings, the distance from the sprinkler deflector to the underside of the ceiling shall not exceed 100 mm.

3.2.3.1 Pendent Sprinkler Locations

Pendent sprinklers in suspended ceilings shall be located in center of ceiling tiles or otherwise a minimum of 150 mm from ceiling grid.

3.2.4 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers shall contain no fittings between the branch line tee and the reducing coupling at the sprinkler. Riser nipples exceeding 750 mm in length shall be individually supported.

3.2.5 Pipe Joints

Pipe joints shall conform to \-NFPA 13-\, except as modified herein. Not more than four threads shall show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by \-NFPA 13-\ at the Contractor's fabrication shop, not at the project construction site. Flanged joints shall be provided where indicated or required by \-NFPA 13-\. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings and fittings shall be from the same manufacturer.

3.2.6 Reducers

Reductions in pipe sizes shall be made with one-piece tapered reducing fittings. The use of grooved-end or rubber-gasketed reducing couplings will not be permitted. When standard fittings of the required size are not manufactured, single bushings of the face type will be permitted. Where used, face bushings shall be installed with the outer face flush with the face of the fitting opening being reduced. Bushings shall not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 15 mm.

3.2.7 Pipe Penetrations

Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors shall be core-drilled and provided with pipe sleeves. Each sleeve shall be Schedule 40 galvanized steel, ductile iron or cast iron pipe and shall extend through its respective wall or floor and be cut flush with each wall surface. Sleeves shall provide required clearance between the pipe and the sleeve per \-NFPA 13-\ The space between the sleeve and the pipe shall be firmly packed with mineral wool insulation. Where pipes pass through fire walls, fire partitions, or floors, a fire seal shall be placed between the pipe and sleeve in accordance with Section \=07270=\ FIRESTOPPING. In penetrations which are not fire-rated or not a floor penetration, the space between the sleeve and the pipe shall be sealed at both ends with plastic waterproof cement which will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

3.2.8 Escutcheons

Escutcheons shall be provided for pipe penetration of ceilings and walls. Escutcheons shall be securely fastened to the pipe at surfaces through which piping passes.

3.2.9 Inspector's Test Connection

Unless otherwise indicated, test connection shall consist of 25 mm pipe connected to the remote branch line; a test valve located approximately 2 meters above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test." The discharge orifice shall be located outside the building wall directed so as not to cause damage to adjacent construction or landscaping during full flow discharge.

3.2.10 Drains

Main drain piping shall be provided to discharge at a safe point outside the building. Auxiliary drains shall be provided as required by \-NFPA 13-\ except that drain valves shall be used where drain plugs are otherwise permitted. Where branch lines terminate at low points and form trapped sections, such branch lines shall be manifolded to a common drain line.

3.2.11 Installation of Fire Department Connection

Connection shall be mounted on the exterior wall approximately 900 mm above finished grade. The piping between the connection and the check valve shall be provided with an automatic drip in accordance with \-NFPA 13-\ and arranged to drain to the outside.

3.2.12 Identification Signs

Signs shall be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by \-NFPA 13-\. Hydraulic design data nameplates shall be permanently affixed to each sprinkler riser as specified in \-NFPA 13-\.

3.3 UNDERGROUND PIPING INSTALLATION

The fire protection water main shall be laid, and joints anchored, in accordance with \-NFPA 24-\. Minimum depth of cover shall be 900 mm. The supply line shall terminate inside the building with a flanged piece, the bottom of which shall be set not less than 150 mm above the finished floor. A blind flange shall be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block shall be provided at the elbow where the pipe turns up toward the floor. In addition, joints shall be anchored in accordance with \-NFPA 24-\ using pipe clamps and steel rods from the elbow to the flange above the floor and from the elbow to a pipe clamp in the horizontal run of pipe. Buried steel components shall be provided with a corrosion protective coating in accordance with \-AWWA C203-\. Piping more than 1500 mm outside the building walls shall meet the requirements of Section \=02660=\ WATER LINES.

3.4 EARTHWORK

Earthwork shall be performed in accordance with applicable provisions of Section \=02221=\ EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS.

3.5 ELECTRICAL WORK

Alarm and supervisory signal wiring connected to the building fire alarm control system shall be in accordance with Section \=16721=\ FIRE DETECTION AND ALARM SYSTEM.

3.6 FIELD PAINTING AND FINISHING

| [AM#2] Field painting and finishing are specified in Section \=09900=\
| PAINTING, GENERAL. Pipes shall have color code markings per specification
| 09900.

3.7 PRELIMINARY TESTS

The system, including the underground water mains, and the aboveground piping and system components, shall be tested to assure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure shall be tested in accordance with \-NFPA 13-\ and \-NFPA 24-\. Upon completion of specified tests, the Contractor shall complete certificates as specified in paragraph SUBMITTALS. A fire protection engineer employed by the contractor shall be on site and witness preliminary tests. He shall certify these systems, including alarming functions, meet \-NFPA 13-\ and \-NFPA 24-\. This certification shall be submitted to the COE prior to scheduling a final acceptance test with the Contracting Officer.

3.7.1 Underground Piping

3.7.1.1 Flushing

Underground piping shall be flushed in accordance with \-NFPA 24-\. This includes the requirement to flush the lead-in connection to the fire protection system at a flow rate not less that the calculated maximum water demand rate of the system.

3.7.1.2 Hydrostatic Testing

New underground piping shall be hydrostatically tested in accordance with \-NFPA 24-\. The allowable leakage shall be measured at the specified test pressure by pumping from a calibrated container. The amount of leakage at the joints shall not exceed 1.89 liters per hour per 100 gaskets or joints, regardless of pipe diameter.

3.7.2 Aboveground Piping

3.7.2.1 Hydrostatic Testing

Aboveground piping shall be hydrostatically tested in accordance with \-NFPA 13-\ at not less than 1400 kPa or 350 kPa in excess of maximum system operating pressure and shall maintain that pressure without loss for 2 hours. There shall be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure shall be

read from a gauge located at the low elevation point of the system or portion being tested.

3.7.3 Testing of Alarm Devices

Each alarm switch shall be tested by flowing water through the inspector's test connection. Each water-operated alarm devices shall be tested to verify proper operation.

3.7.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded on the certificate specified in paragraph SUBMITTALS. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.

3.8 FINAL ACCEPTANCE TEST

A technician employed by the installing Contractor shall be present for the final tests and shall provide a complete demonstration of the operation of the system. This shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches. After operation of control valves has been completed, the main drain test shall be repeated to assure that control valves are in the open position. In addition, the representative shall have available copies of as-built drawings and certificates of tests previously conducted. The installation shall not be considered accepted until identified discrepancies have been corrected and test documentation is properly completed and received.

3.9 FIELD 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. Training shall be scheduled for a Tuesday, Wednesday, or Thursday. The first training session shall be video taped. A VHS formatted tape shall be provided to the Contracting Officer.

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ACCOMPANYING AMENDMENT NO. 0002 TO SOLICITATION NO. DACA63-99-B-0012

SECTION 15405

PLUMBING, HOSPITAL

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-\	(1994) Drinking-Fountains and Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

\-ANSI Z21.10.1-\	(1993; Z21.10.1a) Gas Water Heaters Vol. I Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less
\-ANSI Z21.10.3-\	(1993; Z21.10.3a) Gas Water Heaters Vol III Storage, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters
\-ANSI Z21.22-\	(1986; Z21.22a) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
\-ANSI Z21.56-\	(1991; Z21.56a; Z21.56b) Gas-Fired Pool Heaters
\-ANSI Z124.2-\	(1987; Z124.2a) Plastic Shower Receptors and Shower Stalls
\-ANSI Z358.1-\	(1990) Emergency Eyewash and Shower Equipment

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

\-ASTM A 47-\	(1990) Ferritic Malleable Iron Castings
\-ASTM A 53-\	(1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
\-ASTM A 74-\	(1994) Cast Iron Soil Pipe and Fittings
\-ASTM A 105-\	(1996) Forgings, Carbon Steel, for Piping Components

\-ASTM A 183-\	(1983; R 1990) Carbon Steel Track Bolts and Nuts
\-ASTM A 193-\	(1996) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
\-ASTM A 515-\	(1992) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
\-ASTM A 516-\	(1990) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
\-ASTM A 518-\	(1992) Corrosion-Resistant High-Silicon Iron Castings
\-ASTM A 536-\	(1984; R 1993) Ductile Iron Castings
\-ASTM A 733-\	(1993) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
\-ASTM A 888-\	(1994) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications
\-ASTM B 32-\	(1995) Solder Metal
\-ASTM B 42-\	(1993) Seamless Copper Pipe, Standard Sizes
\-ASTM B 43-\	(1994) Seamless Red Brass Pipe, Standard Sizes
\-ASTM B 75-\	(1993) Seamless Copper Tube
\-ASTM B 88-\	(1993a) Seamless Copper Water Tube
\-ASTM B 111-\	(1993) Copper and Copper-Alloy Seamless Condenser Tubes and Ferule Stock
\-ASTM B 117-\	(1994) Operating Salt Spray (Fog) Testing Apparatus
\-ASTM B 152-\	(1994) Copper Sheet, Strip, Plate, and Rolled Bar
\-ASTM B 306-\	(1992) Copper Drainage Tube (DWV)
\-ASTM B 339-\	(1993) Pig Tin
\-ASTM B 370-\	(1992) Copper Sheet and Strip for Building Construction
\-ASTM B 584-\	(1993b) Copper Alloy Sand Castings for General Applications

\-ASTM B 641-\	(1993) Seamless and Welded Copper Distribution Tube (Type D)
\-ASTM B 813-\	(1993) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
\-ASTM B 828-\	(1992) Making Capillary Joints by Soldering of Copper and Copper-Alloy Tube and Fittings
\-ASTM C 564-\	(1995) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
\-ASTM C 920-\	(1994) Elastomeric Joint Sealants
\-ASTM C 1053-\	(1990) Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
\-ASTM D 609-\	(1990) Preparation of Clad-Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products
\-ASTM D 638-\	(1994b) Tensile Properties of Plastics
\-ASTM D 1004-\	(1994a) Initial Tear Resistance of Plastic Film and Sheeting
\-ASTM D 1193-\	(1991) Reagent Water
\-ASTM D 1248-\	(1984; R 1989) Polyethylene Plastics Molding and Extrusion Materials
\-ASTM D 1527-\	(1994) Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80
\-ASTM D 1784-\	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
\-ASTM D 1785-\	(1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
\-ASTM D 2000-\	(1990; R 1994) Rubber Products in Automotive Applications
\-ASTM D 2235-\	(1993a) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
\-ASTM D 2241-\	(1993) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
\-ASTM D 2447-\	(1993) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
\-ASTM D 2464-\	(1993) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

\-ASTM D 2466-\	(1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
\-ASTM D 2467-\	(1993) Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
\-ASTM D 2468-\	(1993) Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40
\-ASTM D 2485-\	(1991) Evaluating Coatings for High Temperature Service
\-ASTM D 2564-\	(1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
\-ASTM D 2661-\	(1994a) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
\-ASTM D 2665-\	(1994) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
\-ASTM D 2672-\	(1993; R 1995) Joints for IPS PVC Pipe Using Solvent Cement
\-ASTM D 2683-\	(1993) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
\-ASTM D 2822-\	(1991) Asphalt Roof Cement
\-ASTM D 2846-\	(1993) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
\-ASTM D 2855-\	(1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
\-ASTM D 2996-\	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
\-ASTM D 3035-\	(1993) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
\-ASTM D 3122-\	(1993) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings
\-ASTM D 3138-\	(1993) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
\-ASTM D 3139-\	(1989; R 1995) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

\-ASTM D 3212-\	(1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
\-ASTM D 3261-\	(1993) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
\-ASTM D 3308-\	(1991a) PTFE Resin Skived Tape
\-ASTM D 4060-\	(1995) Abrasion Resistance of Organic Coatings by the Taber Abraser
\-ASTM D 4101-\	(1994) Propylene Plastic Injection and Extrusion Materials
\-ASTM D 4551-\	(1991) Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membranes
\-ASTM E 1-\	(1995) ASTM Thermometers
\-ASTM E 96-\	(1995) Water Vapor Transmission of Materials
\-ASTM F 409-\	(1993) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
\-ASTM F 437-\	(1993) Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
\-ASTM F 438-\	(1993) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
\-ASTM F 439-\	(1993a) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
\-ASTM F 441-\	(1994) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
\-ASTM F 442-\	(1994) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
\-ASTM F 477-\	(1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
\-ASTM F 493-\	(1993a) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
\-ASTM F 876-\	(1993) Crosslinked Polyethylene (PEX) Tubing
\-ASTM F 887-\	(1991a) Personal Climbing Equipment
\-ASTM F 913-\	(1994) Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe

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

\-ASHRAE 90.1-\	(1989; 90.1b; 90.1c; 90.1d; 90.1e; 90.1g; 90.1i) Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

\-ASME A112.1.2-\	(1991) Air Gaps in Plumbing Systems
\-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 A112.18.1M-\	(1994; Errata Feb 1995) Plumbing Fixture Fittings
\-ASME A112.19.1M-\	(1994) Enameled Cast Iron Plumbing Fixtures
\-ASME A112.19.2M-\	(1990) Vitreous China Plumbing Fixtures
\-ASME A112.19.3M-\	(1987) Stainless Steel Plumbing Fixtures (Designed for Residential Use)
\-ASME A112.21.1M-\	(1991) Floor Drains
\-ASME A112.21.2M-\	(1983) Roof Drains
\-ASME A112.36.2M-\	(1991) Cleanouts
\-ASME B1.20.1-\	(1983; R 1992) Pipe Threads, General Purpose (Inch)
\-ASME B16.3-\	(1992) Malleable Iron Threaded Fittings
\-ASME B16.4-\	(1992) Cast Iron Threaded Fittings
\-ASME B16.5-\	(1988; Errata Oct 88; B16.5a) Pipe Flanges and Flanged Fittings
\-ASME B16.12-\	(1991) Cast Iron Threaded Drainage Fittings
\-ASME B16.15-\	(1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250
\-ASME B16.18-\	(1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings
\-ASME B16.21-\	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
\-ASME B16.22-\	(1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

\-ASME B16.23-\	(1992; Errata Jan 1994) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
\-ASME B16.24-\	(1991; Errata Jun 91) Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500, and 2500, and Flanged Fittings, Class 150 and 300
\-ASME B16.29-\	(1994) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
\-ASME B16.39-\	(1986; R 1994) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300
\-ASME B19.3-\	(1991; B19.3a) Safety Standard for Compressors for Process Industries
\-ASME B31.1-\	(1995) Power Piping
\-ASME B31.5-\	(1992; B31.5a) Refrigeration Piping
\-ASME B40.1-\	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
\-ASME BPV IV-\	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IV, Heating Boilers
\-ASME BPV VIII Div 1-\	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
\-ASME BPV IX-\	(1995; Addenda Dec 1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
\-ASME CSD-1-\	(1992; CSD-1a; CSD-1b) Controls and Safety Devices for Automatically Fired Boilers

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

\-ASSE 1001-\	(1990) Pipe Applied Atmospheric Type Vacuum Breakers
\-ASSE 1003-\	(1981) Water Pressure Reducing Valves for Domestic Water Supply Systems
\-ASSE 1005-\	(1993) Water Heater Drain Valves - 3/4-Inch Iron Pipe Size
\-ASSE 1006-\	(1986) Residential Use (Household) Dishwashers
\-ASSE 1011-\	(1993) Hose Connection Vacuum Breakers
\-ASSE 1012-\	(1993) Backflow Preventers with Intermediate Atmospheric Vent

\-ASSE 1013-\	(1993) Reduced Pressure Principle Backflow Preventers
\-ASSE 1018-\	(1986) Trap Seal Primer Valves Water Supply Fed
\-ASSE 1037-\	(1990) Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures

AMERICAN WATER WORKS ASSOCIATION (AWWA)

\-AWWA-10062JU-\	(1992) Standard Methods for the Examination of Water and Wastewater
\-AWWA B300-\	(1992) Hypochlorites
\-AWWA B301-\	(1992) Liquid Chlorine
\-AWWA C105-\	(1988) Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
\-AWWA C203-\	(1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
\-AWWA C606-\	(1987) Grooved and Shouldered Joints
\-AWWA C905-\	(1988) Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. Through 36 In.
\-AWWA M20-\	(1973) Manual: Water Chlorination Principles and Practices

AMERICAN WELDING SOCIETY (AWS)

\-AWS A5.8-\	(1992) Filler Metals for Brazing and Braze Welding

CAST IRON SOIL PIPE INSTITUTE (CISPI)

\-CISPI 301-\	(1990) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
\-CISPI HSN-\	(1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings

CODE OF FEDERAL REGULATIONS (CFR)

\-10 CFR 430-\	Energy Conservation Program for Consumer Products
\-21 CFR 175-\	Indirect Food Additives: Adhesives and Components of Coatings

COMMERCIAL ITEM DESCRIPTIONS (CID)

\-CID A-A-238-\	(Rev B) Seat, Water Closet
\-CID A-A-240-\	(Basic) Shower Head, Ball Joint
\-CID A-A-50012-\	(Basic) Garbage Disposal Machine, Commercial
\-CID A-A-50883-\	(Rev A) Bedpan

COMPRESSED GAS ASSOCIATION (CGA)

\-CGA V-5-\	(1989) Diameter-Index Safety System (Non-Interchangeable Low Pressure Connections for Medical Gas Applications)

COPPER DEVELOPMENT ASSOCIATION (CDA)

\-CDA 404/0-RR-\	(1993) Copper Tube for Plumbing, Heating, Air Conditioning and Refrigeration

COUNCIL OF AMERICAN BUILDING OFFICIALS (CABO)

\-CABO A117.1-\	(1992; Errata Jun 1993) American National Standard for Accessable and Usable Buildings and Facilities

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCHR)

\-FCCHR-01-\	(1993) Manual of Cross-Connection Control

HYDRAULIC INSTITUTE (HI)

\-HI-01-\	(1983) Standards for Centrifugal, Rotary & Reciprocating Pumps

IRON AND STEEL SOCIETY (ISS)

\-ISS-222-\	(1990) Steel Products Manual - Stainless and Heat Resisting Steels

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

\-MSS SP-25-\	(1993) Standard Marking System for Valves, Fittings, Flanges and Unions
\-MSS SP-44-\	(1991) Steel Pipe Line Flanges
\-MSS SP-58-\	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
\-MSS SP-67-\	(1995) 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-71-\	(1990) Cast Iron Swing Check Valves, Flanged and Threaded Ends
\-MSS SP-72-\	(1992) Ball Valves with Flanged or Butt-welding Ends for General Service
\-MSS SP-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-\	(1995) Class 3000 Steel Pipe Unions Socket-Welding and Threaded
\-MSS SP-84-\	(1990) Valves - Socket Welding and Threaded Ends
\-MSS SP-85-\	(1994) Cast Iron Globe & Angle Valves Flanged and Threaded Ends
\-MSS SP-110-\	(1992) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

MILITARY STANDARDS (MIL-STD)

\-MIL-STD 1691-\	(Rev E) Construction and Material Schedule for Military Medical and Dental Facilities

NATIONAL ASSOCIATION OF PLUMBING-HEATING-COOLING CONTRACTORS (NAPHCC)

\-NAPHCC-01-\	(1993; Supple 1994) National Standard Plumbing Code (Non-Illustrated Edition)
\-NAPHCC-02-\	(1993) National Standard Plumbing Code (Illustrated Edition)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

\-NEMA 250-\	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
\-NEMA MG 1-\	(1993; Rev 1-1993; Rev 2-1995) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

\-NFPA 31-\	(1992) Installation of Oil Burning Equipment
\-NFPA 54-\	(1992) National Fuel Gas Code

\-NFPA 90A-\	(1993) Installation of Air Conditioning and Ventilating Systems
\-NFPA 99-\	(1993) Health Care Facilities

NSF INTERNATIONAL (NSF)

\-NSF Std 3-\	(1982) Dishwashing Machines/Commercial Spray Type
\-NSF Std 5-\	(1992) Hot Water Generating Equipment
\-NSF Std 14-\	(1965; Rev Nov 1990) Plastics Piping Components and Related Materials

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

\-PPFA-01-\	(1991) Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

\-PDI G-101-\	(1985) Testing and Rating Procedures for Grease Interceptors
\-PDI WH 201-\	(1992) Water Hammer Arresters

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

\-SAE J1508-\	(1993) Hose Clamps

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

\-SSPC SP 5-\	(1991) White Metal Blast Cleaning

UNDERWRITERS LABORATORIES (UL)

\-UL 174-\	(1989; Rev thru Jan 1991) Household Electric Storage-Tank Water Heaters
\-UL 732-\	(1988) Oil-Fired Storage Tank Water Heaters
\-UL 749-\	(1995) Household Dishwashers
\-UL 921-\	(1992) Commercial Electric Dishwashers

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Specified materials and equipment shall be standard items of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least 2 years prior to bid opening.

1.2.2 Performance Requirements

1.2.2.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with \-ASME BPV IX-\. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by \-ASME B31.1-\. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record. Structural members shall be welded in accordance with Section \=05055=\ WELDING, STRUCTURAL.

1.2.2.2 Electrical Work

Motors, motor controllers and motor efficiencies shall conform to the applicable requirements of Section \=16415=\ ELECTRICAL WORK, INTERIOR. Electric motor-driven equipment specified herein shall be provided complete with motors. Equipment shall be rated at 60 Hz, single phase, ac unless otherwise indicated. Motors shall be open, dripproof type unless otherwise indicated. Where a motor controller is not provided in a motor-control center on the electrical drawings, a motor controller shall be provided with the mechanical equipment. Electrical characteristics shall be as indicated. Motor controllers shall be provided complete with properly sized thermal-overload protection in each ungrounded conductor, auxiliary contact, and other equipment at the specified capacity including an allowable service factor, and other appurtenances necessary for the motor control specified. Manual or automatic control and protective or signal devices required for operation herein specified and any wiring required to such devices not shown on the electrical drawings shall be provided under this section. Complete electrical schematic lineless or full line interconnection and connection diagram for each piece of mechanical equipment having more than one automatic or manual electrical control device shall be submitted for approval. Manual or automatic control and protective or signal devices required for operation herein specified and any wiring required to such devices not shown on the electrical drawings shall be provided under this section.

1.3 SUBMITTALS

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

SD-01 Data\

Welding\; *FIO*\.

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Vibration-Absorbing Features\; *FIO*\.

Details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

SD-04 Drawings\

Electrical Schematics\; *FIO*\.

Complete electrical schematic lineless or full line interconnection and connection diagrams for each piece of mechanical equipment having more than one automatic or manual electrical control device.

Plumbing System\; *FIO*\.

Detail drawings consisting of illustrations, schedules, performance charts, instructions, brochures, diagrams, and other information to illustrate the requirements and operation of each system. Detail drawings for the complete plumbing system including piping layout and location of connections; dimensions for roughing-in, foundation, and support points; 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 method. All mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

SD-06 Instructions\

Framed Instructions\; *FIO*\.

Diagrams, instructions, and other sheets, prior to posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

SD-09 Reports\

Tests\; *FIO*\.

Test reports in booklet form showing field tests performed to adjust each component and 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.

SD-13 Certificates\

Outlets\; *FIO*\.

Proof that outlets as an assembly conform to the requirements of Underwriters Laboratories, Inc.

Materials and Equipment\; *FIO*\.

Where materials or equipment are specified to comply with requirements of AGA, or ASME, proof of such compliance shall be included. 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 is specified to conform to ASME requirements, the design, fabrication, and installation shall conform to the code.

Bolts\; *FIO*\.

Written certification from the bolt manufacturer that the bolts furnished comply with specified requirements. The certification shall include illustrations of product-required markings, date of manufacture, and number of each type of bolt to be furnished based on this certification.

SD-19 Operation and Maintenance Manuals\

Plumbing System\; *GA*\.

Six 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 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.

1.4 REGULATORY REQUIREMENTS

Plumbing work shall be in accordance with \-NAPHCC-01-\, unless otherwise stated and installed in accordance with \-NAPHCC-02-\.

1.5 PROJECT/SITE CONDITIONS

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.

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. Plastic pipe, fittings, and solvent cement shall meet \-NSF Std 14-\ and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size. Pipe threads (except dry seal) shall conform to \-ASME B1.20.1-\. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing lead shall not be used in any potable water system. Hubless cast-iron soil pipe shall not be installed under concrete floor slabs or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe shall not be used under ground. Joint and gasket materials shall conform to the following:

a. Coupling for Hubless Cast-Iron Pipe: \-ASTM A 74-\, \-AWWA C606-\.

b. Coupling for Steel Pipe: \-AWWA C606-\.

c. Couplings for Grooved Pipe: Ductile Iron \-ASTM A 536-\ (Grade 65-45-12) Malleable Iron \-ASTM A 47-\, Grade 32510 Copper \-ASTM A 536-\.

d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with \-ASME B16.21-\. Gaskets shall be flat, 1.6 mm thick, and contain aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.

e. Neoprene Gaskets for Hub and Spigot Cast-Iron Pipe and Fittings: \-CISPI HSN-\.

f. Brazing Material: Brazing material shall conform to \-AWS A5.8-\, BCup-5.

g. 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 acidic reagents, contain potassium bromides, and contain fluorides.

h. Solder Material: Solder metal shall conform to \-ASTM B 32-\, 95-5 tin-antimony.

i. Solder Flux: Flux shall be liquid form, non-corrosive, and shall conform to \-ASTM B 813-\, Standard Test 1.

j. Polytetrafluoroethylene Tape, for use with Threaded Metal or Plastic Pipe, and Distilled Water-Piping: \-ASTM D 3308-\.

k. Rubber Gaskets for Cast-Iron Soil Pipe and Fittings: \-ASTM C 564-\.

l. Rubber Gaskets for Grooved Pipe: \-ASTM D 2000-\, maximum temperature 110 degrees C.

m. Flexible Elastomeric Seals: \-ASTM D 3139-\, \-ASTM D 3212-\ or \-ASTM F 477-\.

n. Bolts and Nuts for Grooved Pipe Couplings: Heat treated carbon steel, \-ASTM A 183-\.

o. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: \-ASTM D 3138-\.

p. Plastic Solvent Cement for ABS Plastic Pipe: \-ASTM D 2235-\.

q. Plastic Solvent Cement for PVC Plastic Pipe: \-ASTM D 2564-\ and \-ASTM D 2855-\.

r. Plastic Solvent Cement for CPVC Plastic Pipe: \-ASTM F 493-\.

s. Flanged Fittings: Flanged fittings including flanges, bolts, nuts, bolt patterns, etc. shall be in accordance with \-ASME B16.5-\ Class 150 and shall have the manufacturers trademark affixed in accordance with \-MSS

SP-25-\. Flange material shall conform to \-ASTM A 105-\. Blind flange material shall conform to \-ASTM A 516-\ cold service and \-ASTM A 515-\ for hot service. Bolts shall be high strength or intermediate strength with material conforming to \-ASTM A 193-\.

t. Elastomeric Seals: Elastomeric seals (gaskets) for joining plastic pipe \-ASTM F 477-\: thermoplastic elastomeric seals (gaskets) for joining plastic pipe \-ASTM F 913-\.

u. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: \-ASTM D 3122-\.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arresters: \-PDI WH 201-\.

b. Copper, Sheet and Strip for Building Construction: \-ASTM B 370-\.

c. Asphalt Roof Cement: \-ASTM D 2822-\.

d. Hose Clamps: \-SAE J1508-\.

e. Supports for Off-The-Floor Plumbing Fixtures: \-ASME A112.6.1M-\.

f. Metallic Cleanouts: \-ASME A112.36.2M-\.

g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile, nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

h. Coal-Tar Protective Coating and Linings for Steel Water Pipelines: \-AWWA C203-\.

i. Hypochlorites: \-AWWA B300-\.

j. Liquid Chlorine: \-AWWA B301-\.

k. Polyethylene Encasement for Ductile Iron Piping: \-AWWA C105-\.

l. Gauges - Pressure and Vacuum Indicating Dial Type-Elastic Element: \-ASME B40.1-\.

m. Thermometers: \-ASTM E 1-\.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section \=15250=\ THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to \-MSS SP-58-\ and \-MSS SP-69-\.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves shall be gate valves, unless otherwise specified or indicated. Valves 65 mm and smaller shall be bronze, with threaded bodies for pipe and solder-type connections for tubing. Valves 80 mm and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	\-MSS SP-67-\
Cast-Iron Gate Valves, Flanged and Threaded Ends	\-MSS SP-70-\
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	\-MSS SP-71-\
Ball Valves with Flanged or Butt-Welding Ends for General Service	\-MSS SP-72-\
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	\-MSS SP-110-\
Cast-Iron Plug Valves, Flanged and Threaded Ends	\-MSS SP-78-\
Bronze Gate, Globe, Angle, and Check Valves	\-MSS SP-80-\
Steel Valves-Socket Welding and Threaded Ends	\-MSS SP-84-\
Faucets For High-Purity Water (De-ionized or Distilled) Either of the Following:	
Polyvinyl Chloride Composition of Valves	\-ASTM D 1784-\, Class 1245-B
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	\-MSS SP-85-\
Backwater Valves	\-ASME A112.14.1-\
Vacuum Relief Valves	\-ASSE 1001-\
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 BPV IV-\
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	\-ASME CSD-1-\, Part CW, Article 5

2.3.1 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, "P" trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow, no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

2.3.2 Wall Faucets

Wall faucets with vacuum breaker backflow preventer shall be brass with 20 mm male inlet threads, hexagon shoulder, and 20 mm hose connection. Faucet handle shall be securely attached to stem.

2.3.3 Wall Hydrants

Wall hydrants with vacuum breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removeable through the face of the hydrant. The hydrant shall have 20 mm exposed hose thread on spout and 20 mm male pipe thread on inlet.

2.3.4 Lawn Faucets

Lawn faucets shall be brass, with either straight or angle bodies, and shall be of the compression type. Body flange shall be provided with internal pipe thread to suit 20 mm pipe. Body shall be suitable for wrench grip. Faucet spout shall have 20 mm exposed hose threads. Faucet handle shall be securely attached to stem.

2.3.5 Yard Hydrants

Yard box or post hydrants shall have valve housings located below frost lines. Water from the casing shall be drained after valve is shut off. Hydrant shall be bronze with cast-iron box or casing guard. "T" handle key shall be provided.

2.3.6 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to \-ANSI Z21.22-\, have 20 mm minimum inlets, and 20 mm outlets for systems where the maximum rate of heat input is less than 59 kW. Relief valves rated according to \-ASME BPV IV-\, or \-ASME CSD-1-\, shall have 25.0 mm minimum inlets, and 25.0 mm outlets for systems where the maximum rate of heat input is greater than 59 kW. The discharge pipe from the (P&T) valve shall be the size of the valve outlet.

2.3.7 Thermostatic Mixing Valves and Cabinets

2.3.7.1 Mixing Valves

Mixing valves, thermostatic type, shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 2 degrees C of any setting.

2.3.7.2 Cabinets

Cabinets for mixing valves shall be constructed of 1.519 mm thick minimum sheet metal of a size to accommodate the equipment to be installed therein, shall be rigidly assembled with joints welded, and shall be punched or drilled for the passage of required pipes and services. Cabinets shall be designed for recessed mounting in wall construction, with front flush with tile or plaster finish, and shall have flush-fitting continuously hinged doors. Cabinets shall be equipped with friction catch and pull. Doors and trim shall be flush with front of cabinet and shall be constructed of 1.519 mm thick minimum sheet metal. Doors shall open through 180 degrees. The interior of the cabinets shall be cleaned, filled and primed, and factory finished with two coats of gray semigloss baked-on enamel. The exterior of the cabinets shall be cleaned and filled and factory primed with one coat baked-on enamel primer.

2.3.7.3 Hardware for Mixing-Valve Cabinets

Each door of cabinets shall have a chromium-plated brass continuous hinge. Locks shall be keyed alike. Each inactive door of two-door cabinets shall have two 101.6 mm surface bolts mounted on the inside, one at the top and one at the bottom. Each door of cabinets shall have an approved friction catch and chromium-plated knob.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with \-NAPHCC-01-\ and installed in accordance with \-NAPHCC-02-\. Fixtures for use by the

physically handicapped shall be in accordance with \-CABO 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, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports. Pipe, valves, and fittings exposed to view shall be chromium plated. Fixtures and trim not covered by \-MIL-STD 1691-\ shall be considered special, but shall be of equal quality and material. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 82 degree C water temperature. Plumbing fixtures shall be as listed below. Shower heads, other than emergency showers, shall include a non-removable, tamperproof flow control device which shall limit water flow to 0.16 liters per second when tested in accordance with \-ASME A112.18.1M-\.

2.4.1 Flushometer Valves

Flushometer valves shall have a non-hold-open feature with backcheck angle control stop and a vacuum breaker. Flushometer valves shall be large diaphragm type, having a minimum upper chamber inside diameter of not less than 66.7 mm at the point where the diaphragm is sealed between the upper and lower chambers. Flushometer valves shall conform to \-ASSE 1037-\.

2.4.2 Shower Bath Outfits

Shower bath with outfits, shall be provided.

2.4.3 Joint Schedule Fixtures

The following Joint Schedule Numbers (JSN) for plumbing fixture items are as shown in \-MIL-STD 1691-\. Description of the fixture may vary from that in \-MIL-STD 1691-\.

JSN P1960 Station, Wash, Eye/Face, Countertop

Emergency eye wash station countertop mounted. Unit shall provide a soft stream of water to both eyes and face when a push type ball valve is actuated. Shall have twin chrome plated brass anti-surge heads angled to direct ample streams of water into eyes. Shall comply with AMST standards and OSHA regulations.

Similar to HAWS Drinking Faucet Company Model 7612 or approved equal.

JSN P2000 Station, Wash, Eye/Face, Wall Mounted

Emergency eye wash station wall mounted with stainless steel receptor. Unit shall provide a soft stream of water to both eyes and face when a push type ball valve is actuated. Shall have twin ABS plastic anti-surge heads angled to direct ample streams of water into eyes. Shall comply with AMST standards and OSHA regulations.

Similar to Haws Drinking Faucet Company Model 7060BT or approved equal.

JSN P3000 Lavatory, China

Lavatory wall mounted, 508mm x 457mm, 102mm x 178mm back. Shall conform with FS WWP-541/4a, Type I part C: Type III, part D; Type IV, part E; Type I or II as applicable, Part F; type I, Class 1, 2, 3 or as applicable. Lavatory shall be vitreous china. Lavatory shall be equipped with gooseneck spout and 102mm wrist blade handles.

Similar to American Standard Model #0355.027 and 2238.202 or approved equal.

JSN P3070 Lavatory, Patient, China, Recessed

Lavatory, patient, for use in patient toilet room: shall be vitreous china, suitable, for recessed installation counter top. The basin shall be 406mm x 254mm front to back and 152mm deep. Fixture shall be shelf-rimmed or shall be provided with a CRS rim trim and fitted with 102mm wrist action handles and gooseneck supply. ASME A112.19.2M.

Similar to American Standard Model #0475.020, 0000.372H, and 6801.00 or approved equal.

JSN P3100 Lavatory, Clinic, China

Lavatory wall mounted, 508mm x 257mm. Shall conform with FS WWP-541/4a, Type I part C: Type III, part D; Type IV, part E; Type I or II as applicable, Part F; type I, Class 1, 2, 3 or as applicable. Lavatory shall be vitreous china. Lavatory shall be equipped with gooseneck spout and 102mm wrist blade handles.

Similar to American Standard Model 0194.076 and 2238.202 or approved equal.

JSN P4700 Sink, Mop, Molded Stone

Basin, mop service: molded-stone, 914mm x 610mm x 254mm high, built under heat and pressure, resulting in a one-piece, homogeneous product or enameled coated cast iron basin. Provide a service faucet with vacuum breaker, adj. brace.

Similar to American Standard Model 7740.020 and 8344.111 or approved equal.

JSN P5040 Shower, Single

Hand shower with slide bar, supply bracket, shower head, supply hose, and thermostatic or pressure balancing mixing valve, shall conform to FS WW-P-541/7A, Part a: type III Part G type 1A, class 1. Polished Chrome finish.

Similar to American Standard Model 1662.600 and 1495.432 or approved equal.

JSN P6150 Sink, Washing, Cage, CRS

Sink, Washing wall mounted, 14 gauge stainless steel, 508mm W x 635mm D x 508mm H with service faucet equipped with 152mm wrist action handles.

Similar to Elkay Model EWS-2520-W6-C or approved equal.

JSN P6350 Sink, Flushing Rim, China

Sink, flushing rim, wall hung, top spud, wall faucet, flush valve and 3 rim guards. Shall of shall be vitreous china.

Similar to American Standard Model 9512.013 and 1495.432 and Sloan Royal 117H or approved equal.

JSN P8150 Urinal, Wall Hung

Urinal shall be wall hung conforming to FS WW-P-541/2A Part A type I, style A class 1, 2, or 3 as required. Part B: type I or II style A, class 1, with carrier.

Similar to American Standard Model 6501.010 and Sloan Royal 186 or approved equal.

JSN P9050 Toilet, Wall Hung, Siphon Jet

Water closet, siphon jet, wall hung, elongated bowl flush valve, shall conform with FS WW-P-541/1A: part A type II, Style D, Class 9; part C type IV, class 4; part D type 1, style F5 or F9, class 2 or 3; part E type I or II, style 1, model A; part F type II. Seat shall be white in color, open front without cover, with check hinge.

Similar to American Standard Model 2477.016 and Sloan Royal 110-3 or approved equal.

JSN R2201 Fountain, Water, CRS, Wall Mounted

Drinking water dispenser, stainless steel, satin finish, wall mounted, combination handicap and general public use (2 Level) dispenser, air cooled compressor, fan cooled condenser, 115 Volt, 60 Hz, single phase. ARI 1010.

Similar to Elkay ERHP2-8 or approved equal.

2.5 BACKFLOW PREVENTERS

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced-pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with \-FCCHR-01-\. Backflow preventers

with intermediate atmospheric vent shall conform to \-ASSE 1012-\. Reduced pressure principle backflow preventers shall conform to \-ASSE 1013-\. Hose connection vacuum breakers shall conform to \-ASSE 1011-\. Pipe applied atmospheric type vacuum breakers shall conform to \-ASSE 1001-\. Air gaps in plumbing systems shall conform to \-ASME A112.1.2-\.

2.6 DRAINS

2.6.1 Floor and Shower Drains

Floor and shower 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 drain pipe. 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-\.

2.6.1.1 Metallic Shower Pan Drains

Where metallic shower pan membrane is installed, polyethylene drain with corrosion-resistant screws for securing the clamping device shall be provided. Polyethylene drains shall have fittings to adapt drain-to-waste piping. Polyethylene floor drains shall be constructed of polyethylene conforming to \-ASTM D 1248-\. Drains shall have separate cast-iron "P" trap, circular body, seepage pan, and chrome-plated strainer, unless otherwise indicated.

2.6.2 Roof Drains and Expansion Joints

Roof drains shall conform to \-ASME A112.21.2M-\ with dome and integral flange, and shall have a device for making a watertight connection between roofing and flashing; the whole assembly shall be galvanized heavy pattern cast iron. For aggregate surface roofing, the drain shall be provided with a gravel stop. On roofs other than concrete construction, roof drains shall be complete with underdeck clamp, sump receiver, and an extension for the insulation thickness where applicable. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or membrane shall be provided when required to suit the building construction. Strainer openings shall have a combined area equal to twice that of the drain outlet. The outlet shall be equipped to make a proper connection to threaded pipe of the same size as the downspout. An expansion joint of proper size to receive the conductor pipe shall be provided. The expansion joint shall consist of a heavy cast-iron housing, brass or bronze sleeve, brass or bronze fastening bolts and nuts, and gaskets or packing. The sleeve shall have a nominal thickness of not less than 3.416 mm. Gaskets and packing shall be close-cell neoprene; O-ring packing shall be close-cell neoprene of 70 durometer. Packing shall be held in place by a packing gland secured with bolts.

2.7 WATER COOLERS

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 20.3 liters per hour of 10 degree C water when supplied with 27 degree C inlet water and a 32 degree C room temperature.

2.8 SHOWER PAN

2.8.1 Plasticized Chlorinated Polyvinyl Chloride Shower Pan Material

Material shall be sheet form. The material shall be 1.016 mm minimum thickness of plasticized polyvinyl chloride or chlorinated polyethylene and be in accordance with \-ASTM D 4551-\.

2.8.2 Nonplasticized Polyvinyl Chloride (PVC) Shower Pan Material

Material shall consist of a plastic waterproofing membrane in sheet form. The material shall be 1.016 mm minimum thickness of nonplasticized PVC and shall have the following minimum properties:

a. \-ASTM D 638-\:

Ultimate Tensile Strength: 17.9 MPa

Ultimate Elongation: 398 percent

100 Percent Modulus: 3.07 MPa

b. \-ASTM D 1004-\:

Tear Strength: 53 kN/meter

c. \-ASTM E 96-\:

Permeance: 0.46 nanograms per pascal-second-sq. meter

d. Other Properties:

Specific Gravity: 1.29

PVC Solvent: Weldable

Cold Crack: - 47 degrees C

Dimensional stability, 100 degrees C: 2.5 percent

Hardness, Shore A: 89

2.9 TRAPS

Traps shall be copper alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Tubes shall be copper alloy with walls not less than 0.81 mm 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 50 mm. The interior diameter shall be not more than 6 mm over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A plastic or copper-alloy "P" trap assembly consisting of an adjustable "P" trap and threaded 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.

2.10 WATER HEATERS

Water heater types and capacities shall be as indicated. Each primary water heater shall have controls adjustable from 23 to 49 degrees C. Each booster water heater shall have controls adjustable from 49 to 71 degrees C. Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and stand by heat losses shall conform to Table III, for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 2000 liter storage capacity need not meet the standby loss requirements if the tank surface area is not insulated to R-12.5 and if a standing pilot light is not used.

2.10.1 Automatic Storage Type

Heaters shall be complete with control system, temperature gauge, and pressure gauge, and shall have ASME rated combination pressure and temperature relief valve.

2.10.1.1 Gas Fired Type

Gas fired water heaters shall conform to \-ANSI Z21.10.1-\ when input is 22 kW or less or \-ANSI Z21.10.3-\ for heaters with input greater than 22 kW.

-\2.11 PUMPS

2.11.1 Sump Pumps

Sump pumps shall be of capacities indicated. The pumps shall be of the automatic, electric motor driven, submerged type, complete with necessary control equipment and with a split or solid cast-iron or steel cover plate. Each pump shall be directly connected by an approved flexible coupling to a vertical electric motor having a continuous oiling device or packed bearings sealed against dirt and moisture. Motors shall be totally enclosed, fan-cooled of sizes as indicated and each shall be equipped with an across-the-line magnetic controller in a \-NEMA 250-\, Type 1 enclosure. Each pump shall be fitted with a high grade thrust bearing mounted above the floor. Each shaft shall have an alignment bearing at each end, and the suction inlet shall be between 75 and 150 mm above the sump bottom. The suction side of each pump shall have a strainer of ample capacity. A float switch assembly, with the switch completely enclosed in a \-NEMA 250-\, Type 1 enclosure, shall start and stop each motor at predetermined water levels. Duplex pumps shall be equipped with an automatic alternator to change the lead operation from one pump to the other, and for starting the second pump

if the flow exceeds the capacity of the first pump. The discharge line from each pump shall be provided with a union or flange, a nonclog swing check valve, and a stop valve in an accessible location near the pump.

2.11.2 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single stage, centrifugal, mechanical seals, suitable for the intended service. Pump capacities, efficiencies, motor sizes, speeds, and impeller types shall be as shown. Pump and motor shall be integrally mounted on a cast-iron or steel subbase, close-coupled with an overhung impeller, or supported by the piping on which it is installed. The shaft shall be one piece, heat-treated, corrosion-resisting steel with impeller and smooth surfaced housing of bronze. Motor shall be totally enclosed, fan-cooled and shall have sufficient wattage for the service required. Pump shall be hydraulically balanced and shall conform to \-HI-01-\. Each pump motor shall be provided with enclosed, across-the-line type, magnetic controller complete in a \-NEMA 250-\, Type 1 enclosure with "START-STOP" switch in cover. Pump motors smaller than 746 W shall have integral thermal overload protection in accordance with Section \=16415=\ ELECTRICAL WORK, INTERIOR. Guards shall shield exposed moving parts.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

| [AM#2] Hubless cast-iron pipe shall not be installed under concrete floor slabs. Hubless cast-iron soil pipe shall not be installed in crawl space ~~below kitchen floors~~. Piping located in air plenums shall conform to \-NFPA 90A-\ requirements. ~~Plastic pipe shall not be installed in air plenum. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with \-PPFA-01-\.~~ The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 1.5 meters outside the building, unless otherwise indicated. A gate or full port ball ball valve and drain on the water service line shall be installed inside the building approximately 150 mm above the floor from point of entry. 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. Exterior underground utilities shall be at least 300 mm below the average local frost depth 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 with handle horizontal to or above the valve body.

3.2 WATER PIPE, FITTINGS, AND CONNECTIONS

3.2.1 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, flushing devices, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the time for repair and maintenance without interfering with operation of

other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.2.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting through construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.2.3 Protection to Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.2.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. 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 shall be kept a sufficient distance from other work and other services to permit not less than 15 mm 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 prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Buried pipe shall be inspected, tested, and approved before backfilling. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific excepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 100 mm 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 six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.2.5 Pipe Drains

Pipe drains indicated shall consist of 20 mm hose bibb with renewable seat and gate or full port ball valve ahead of hose bibb. At other low points, 20 mm brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.2.6 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 15 meters 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.

3.2.7 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters, conforming to \-PDI WH 201-\, shall be provided on hot and cold water supplies and shall be located as generally indicated, with precise location and sizing per \-PDI WH 201-\. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Vertical capped pipe columns will not be permitted.

3.3 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. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.3.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to \-ASME B1.20.1-\. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.3.2 Mechanical Couplings

Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous or non-ferrous, domestic hot and cold water systems, in lieu of unions, brazed, soldered, welded, flanged, 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 862 kPa service and appropriate for static head plus the pumping head, and shall provide a watertight 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 a site agreed upon. 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.

3.3.3 Unioned and Flanged

Unions and flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 65 mm and smaller; flanges shall be used on pipe sizes 80 mm and larger.

3.3.4 Cast Iron Pipe

Cast iron soil, waste and vent pipe joints shall be bell and spigot compression and hubless gasketed clamped joints installed per the manufacturer's recommendations.

3.3.5 Copper Tube and Pipe

Joints shall be made up with fittings of compatible material and made for the purpose intended. The tube or fittings shall not be annealed when making connections. Connections shall be made with a multiflame torch.

a. Brazed. Brazed joints shall conform to \-MSS SP-73-\ and \-CDA 404/0-RR-\, made with flux, and are acceptable for all lines sizes.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for lines 50 mm and smaller. Soldered joints shall conform to \-ASME B31.5-\ and \-CDA 404/0-RR-\.

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. Branch tube shall be notched for proper penetration into fitting to assure 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.

d. Mechanical couplings may be used in conjunction with grooved tube for aboveground, nonferrous, domestic hot and cold water systems in lieu of unions, brazed, soldered, or threaded joints. Mechanical couplings are permitted only in accessible locations, including behind access plates. 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 tube. 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 tube couplings shall be used with grooved end tubes, fittings, and valves. Rigid couplings shall be

designed for not less than 862 kPa service appropriate for static head plus the pumping head, and shall provide a watertight joint. Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally brazed or soldered 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 tube, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications.

3.3.6 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous pipe shall be made with dielectric unions, flanges or dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fittings for this specific purpose.

3.4 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-\.

3.5 PIPE SLEEVES AND FLASHING

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.5.1 Sleeve Requirements

Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves will 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 with sleeves of proper diameter 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 wall, 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 100 mm above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 6 mm clearances 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 with sealants conforming to \-ASTM C 920-\ and with primer backstop material and surface preparation as specified in Section \=07920=\ JOINT SEALING. 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.

3.5.2 Flashing Requirements

Pipes passing through roof or floor waterproofing membrane shall be installed through a lead flashing or a 4.9 kg/sq meter copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed; the skirt or flange shall extend not less than 200 mm 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 250 mm. 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 copper flashing, with an adjustable integral flange of adequate size to extend not less than 200 mm from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between flashing and bare pipe or between flashing and metal-jacket covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 250 mm 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. A waterproofing clamping flange shall be installed.

3.5.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 40 mm 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 40 mm; then the sealant shall be finished off flush to floor level between the flashing

guard and drainpipe. The flashing guard of sheet copper shall extend not less than 200 mm 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 40 mm 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 to form a seal.

3.5.4 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 150 mm in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.6 FIRE SEAL

Where pipes pass through fire walls, fire partitions, fire rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section \=07270=\ FIRESTOPPING.

3.7 SUPPORTS

Hangers used to support piping 50 mm 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. 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.

3.7.1 Pipe Support and Structural Bracing Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as shown. Structural steel required for reinforcement to properly support piping, headers, and equipment but not shown shall be provided. Material used for supports shall be as specified in Section \=05120=\ STRUCTURAL STEEL.

3.7.2 Pipe Hangers, Inserts, and Supports

Pipe hanger, insert and support 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. Types 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 insulated pipe 100 mm and larger when the temperature of the medium is 16 degrees C or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

(1) Be used on insulated pipe less than 100 mm.

(2) Be used on insulated pipe 100 mm and larger when the temperature of the medium is 16 degrees C or less.

(3) Have a high density insert for pipe 50 mm and larger and for smaller pipe sizes when the insulation is suspected of being visibly compressed, or distorted at or near the shield/insulation interface. High-density inserts shall have a density of 144 kg per cu. meter or greater.

i. Horizontal pipe supports shall be spaced as specified in \-MSS SP-69-\ and a support shall be installed not over 300 mm from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 meters apart at valves. Operating temperatures of 49 degrees C for PVC pipe and 82 degrees C for CPVC shall be used in determining hanger spacing for PVC or CPVC pipe. Horizontal pipe runs shall include allowances for expansion and contraction.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 5 meters, nor more than 2 meters from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

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 100 mm and larger when the temperature of the medium is 16 degrees C or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 100 mm, a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 100 mm and larger carrying medium less than 16 degrees C, a Type 40 shield, attached to the pipe or insulation, may freely rest on 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, 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 100 mm, or by an amount adequate for the insulation, whichever is greater.

3.8 WELDED INSTALLATION

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to \-ASME B31.1-\. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.9 PIPE CLEANOUTS

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 100 mm 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 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 100 mm. 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 450 mm of crawl space is provided under the floor. Pipe cleanouts 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 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 head cleanouts shall be provided with adjustable cast iron or plastic heads.

3.10 VALVES, OUTLETS, AND DISPENSERS

3.11 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, or sweat inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beaded tool shall be used to mechanically deform the tubing above the compression fittings. 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. Stops for water closet seats shall be installed on the wall.

3.11.1 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.

3.11.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finish connection to top spud adjacent to valve, to the wall with approved metal bracket.

3.11.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 775 mm above finished floor. Wall-hung drinking fountains shall be installed with rim 1.05 meters above floor. Wall-hung service sinks shall be mounted with rim 700 mm above the floor. Installation of fixtures for use by the physically handicapped shall conform to \-CABO A117.1-\.

3.11.4 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

3.11.5 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.

3.11.5.1 Concrete or Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.11.5.2 Cellular-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the cellular wall using through bolts and a back-up plate.

3.11.5.3 Steel Stud Frame Partitions

Floor anchored chair carriers shall be used. The anchor feet and tubular uprights shall be of the heavy duty design. Feet (bases) shall be steel and welded to a square or rectangular steel tube upright.

3.11.5.4 Wall-Mounted Water Closet Gaskets

When 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.

3.11.6 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with \-NAPHCC-01-\ at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.11.7 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 \=05500=\ MISCELLANEOUS METAL.

3.11.8 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 50 mm above the flood rim of the funnel to provide an acceptable air gap.

3.11.9 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.

3.11.10 Shower Pans

Before installing shower pan, subfloor shall be free of projections such as nail heads or rough edges of aggregate. Drain shall be a bolt-down, clamping-ring type with weepholes, installed so the lip of the subdrain is flush with subfloor. The floor of each individual shower, the shower area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curbing or partition shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to size and shape of the area indicated, in one piece to the maximum extent practicable, allowing a minimum of 150 mm for turnup on walls or partitions, and shall be folded over the curb with an approximate return of 1/4 of curb height. The upstands shall be placed behind any wall or partition finish. Subflooring shall be smooth and clean, with nail heads driven flush with surface, and shall be sloped to drain. Shower pans shall be clamped to drain with the drain clamping ring.

3.11.10.1 Metal Shower Pans

When a shower pan of required size cannot be furnished in one piece, metal pieces shall be joined with a flat-lock seam and soldered or burned. The corners shall be folded, not cut, and the corner seam shall be soldered or burned. Pans, including upstands, shall be coated on all surfaces with one brush coat of asphalt. Asphalt shall be applied evenly at not less than 1 liter per square meter. A layer of felt covered with building paper shall be placed between shower pans and wood floors. The joining surfaces of metal pan and drain shall be given a brush coat of asphalt after the pan is connected to the drain.

3.11.10.2 Nonplasticized Chlorinated Polyethylene Shower Pans

Corners of nonplasticized chlorinated polyethylene shower pans shall be folded against the upstand by making a pig-ear fold. Hot-air gun or heat lamp shall be used in making corner folds. Each pig-ear corner fold shall be nailed or stapled 15 mm from the upper edge to hold it in place. Nails shall be galvanized large-head roofing nails. On metal framing or studs, approved duct tape shall be used to secure pig-ear fold and membrane. Where no backing is provided between the studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding 5 mm from upper edge. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it will be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Surfaces to be solvent-welded shall be clean. Surfaces to be joined with xylene shall be initially sprayed and vigorously cleaned with a cotton cloth, followed by final coating of xylene and the joining of the surfaces by roller or equivalent means. If ambient or

membrane temperatures are below 4 degrees C, the membrane and the joint shall be heated prior to application of xylene. Heat may be applied with hot-air gun or heat lamp, taking precautions not to scorch the membrane. Adequate ventilation and wearing of gloves are required when working with xylene. Membrane shall be pressed into position on the drain body, and shall be cut and fit to match so that membrane can be properly clamped and an effective gasket-type seal provided. On wood subflooring, two layers of 0.73 kg per sq. meter dry felt shall be installed prior to installation of shower pans to assure a smooth surface for installation.

3.11.10.3 Plasticized Polyvinyl Chloride (PVC) Shower Pans

Plasticized PVC shall be turned up behind walls or wall surfaces a distance of not less than 150 mm in room areas and 75 mm above curb level in curbed spaces with sufficient material to fold over and fasten to outside face of curb. Corners shall be pig-ear type and folded between pan and studs. Only top 25 mm of upstand shall be nailed to hold in place. Nails shall be galvanized large-head roofing type. Approved duct tape shall be used on metal framing or studs to secure pig-ear fold and membrane. Where no backing is provided between studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding at top inch of upstand. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it will be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Trim for drain shall be exactly the size of drain opening. Bolt holes shall be pierced to accommodate bolts with a tight fit. Adhesive shall be used between pan and subdrain. Clamping ring shall be bolted firmly. A small amount of gravel or porous material shall be placed at weepholes so that holes remain clear when setting bed is poured. Membrane shall be solvent welded with PVC solvent cement. Surfaces to be solvent welded shall be cleaned free of grease and grime. Sheets shall be laid on a flat surface with an overlap of about 50 mm. Top edge shall be folded back and surface primed with a PVC primer. PVC cement shall be applied and surfaces placed together at once, while still wet. Joint shall be lightly rolled with a paint roller, then as the joint sets shall be rolled firmly but not so hard as to distort the material. On long lengths, about 600 or 900 mm at a time shall be welded. On wood subflooring, two layers of 0.73 kg per sq. meter felt shall be installed prior to installation of shower pan to assure a smooth surface installation.

3.12 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by approved vibration-absorbing features. Each foundation shall include standard isolation units as indicated. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed loading rating. Piping connected to mechanical equipment shall be provided with flexible connectors. Isolation unit installation shall limit vibration to percent of the lowest equipment rpm.

3.13 WATER HEATERS AND HOT WATER STORAGE TANKS

3.13.1 Relief Valves

Valves shall not be installed between a relief valve and its water heater or storage tank. The relief valves shall be installed where the valve actuator

comes in contact with the hottest water in the heater or tank. 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 vacuum relief valve shall be provided on the cold water supply line to the hot water storage tank or water heater and mounted above and within 150 mm of the tank or water heater.

3.13.2 Gas and Oil Fired Water Heaters

Installation shall conform to \-NFPA 54-\ for gas fired and \-NFPA 31-\ for oil fired.

3.13.3 Storage Water Heaters

Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers shall be installed with heat traps directly on both the inlet and outlets. Circulating systems need not have heat traps installed. An acceptable heat trap may be a piping arrangement such as elbows connected so that the inlet and outlet piping make vertically upward runs of not less than 600 mm just before turning downward or directly horizontal into the water heater's inlet and outlet fittings. Commercially available heat traps, specifically designed by the manufacturer for the purpose of effectively restricting the natural tendency of hot water to rise through vertical inlet and outlet piping during standby periods, may also be approved.

3.13.4 Heat Traps

Piping to and from each water heater and hot water storage tank shall be routed horizontally or downward a minimum of 600 mm before turning in an upward direction.

3.13.5 Connections to Water Heaters

Connections to water heaters and metallic pipe shall be made with dielectric unions or flanges.

3.14 IDENTIFICATION SYSTEMS

3.14.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number, shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 35 mm minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.14.2 Color Coding

Color coding for piping identification shall be as specified in Section \=09900=\ PAINTING, GENERAL.

3.14.3 Color Coding Scheme for Locating Hidden Utility Components

[AM#2] Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 9.5 mm in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 1 meter width, 750 mm height, and 12 mm thickness. The board shall be made of wood fiberboard and framed under glass or 1.6 mm transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 20 mm in diameter and the related lettering in 13 mm high capital letters. The color code board shall be mounted and located in the mechanical or equipment room. The color code system shall be as indicated below÷. After approval of color boards, provide two (2) additional color boards to be installed inside of the building as directed by the C.O.R..

Color	System	Item	Location
Green	Cold Water (Potable)	Valve	Crawl space
Green	Hot Water (Potable)	Valve	Crawl space

3.15 ESCUTCHEONS

Escutcheons shall be provided to 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.

3.16 PAINTING

Painting of pipes, hangers, supports, and other iron work, in concealed spaces or exposed, is specified in Section \=09900=\ PAINTING, GENERAL.

3.17 TESTS, FLUSHING, AND STERILIZATION

3.17.1 Plumbing System

The plumbing system shall be tested in accordance with \-NAPHCC-01-\.

3.17.2 Phenolic Resin Coatings

A certificate of compliance shall be submitted by the coating manufacturer that documents successful use of coating system under service conditions indicated on the drawings for a minimum of 2 years at three different

locations and that certifies that the coating material and application comply with the testing procedures outlined in this specification.

3.17.2.1 \+Test Panels+\

Test panels shall be prepared in accordance with \-ASTM D 609-\. If steel test panels are utilized, the steel substrate shall be 0.607 mm in thickness. The panels shall be coated with one coat wash primer, then pigmented baking phenolic to a dry film thickness of 0.1016 to 0.1524 mm, then clear baking phenolic to a total dry film thickness of 0.1270 to 0.1778 mm. The panels shall then be subjected to the tests specified in the following paragraphs.

3.17.2.2 \+Heat Test+\

A coated test panel shall show no cracking, flaking, or other failure after the panel has been tested in accordance with \-ASTM D 2485-\, with a furnace temperature of 204 degrees C.

3.17.2.3 \+Abrasion Test+\

A coated test panel shall show no more than a 40 milligram loss when tested in accordance with \-ASTM D 4060-\, utilizing a Tabor Abraser CS-17F wheel with a 1000 g. weight for 1000 cycles.

3.17.2.4 \+Corrosion Test+\

A coated test panel shall show no corrosion after being subjected to a 500 hour salt spray test in accordance with \-ASTM B 117-\.

3.18 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. Repairs to piping shall be made with new material. No caulking or screwed joints or holes will be acceptable.

3.19 SYSTEM FLUSHING

After tests are completed, potable water piping shall be flushed. In general, sufficient water shall be used to produce minimum water velocity of 0.762 meters 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, system shall be prepared for service by immediately filling water piping with clean, fresh potable or high-purity water as applicable to the system being flushed. 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. Flushing devices and automatic control systems shall be adjusted for proper operation.

3.19.1 \+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. Pump suction and discharge pressures.

f. Temperature of domestic hot water supply.

g. Operation of each floor and roof drain by flooding with water.

h. Operation of each vacuum breaker and backflow preventer.

i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.

j. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

k. Operational test and verification of purity of medical gas systems. Each outlet shall be tested and installation certified as to correctness of installation. The tests shall be performed by an independent testing company and a certification document provided stating that the entire medical gas system, for each individual gas, has been tested, found correctly installed, and the purity of the delivered gas has been verified.

3.19.2 Sterilization

After pressure tests have been made, the entire domestic hot-and-cold water distribution system to be sterilized shall be flushed with water until entrained dirt and other foreign material have been removed, before introducing chlorinating material. The chlorinating material shall be either liquid chlorine or hypochlorite. Water chlorination procedure shall be in accordance with \-AWWA M20-\. The chlorinating material shall be constantly fed into the water piping system 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 1 ppm. 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-10062JU-\. 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.

TABLE I

PIPE AND FITTING MATERIALS FOR

DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE					
Item No.	Pipe and Fitting Material	A	B	C	D	E	F
1	Cast-iron soil pipe and fittings, hub and spigot, \-ASTM A 74-\	X	X	X	X	X	
2	Cast-iron soil pipe and fittings, hubless, \-CISPI 301-\ and \-ASTM A 888-\	X	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	X	
5	Grooved pipe couplings, ferrous pipe, \-ASTM A 536-\ and \-ASTM A 47-\; non-ferrous pipe, \-ASTM A 536-\ and \-ASTM A 47-\		X			X	
6	Ductile iron grooved joint fittings for ferrous pipe, \-ASTM A 536-\ and \-ASTM A 47-\		X		X		

	for use with Item 5						
7	Malleable-iron threaded fittings, galvanized, \-ASME B16.3-\ for use with Item 6				X	X	
8	Steel pipe, seamless galvanized, \-ASTM A 53-\, Type S, Grade B	X		X	X	X	
9	Seamless red brass pipe, \-ASTM B 43-\				X	X	X
10	Bronze flanged fittings, \-ASME B16.24-\ for use with Item 9				X	X	
11	Cast-copper alloy solder joint pressure fittings.				X	X	
12	Bronze and sand castings, grooved joint pressure fittings for Non-Ferrous Pipe, \-ASTM B 584-\ for Use with Item 5			X		X	
13	Wrought copper grooved joint pressure fittings for non-ferrous Pipe, \-ASTM B 75-\ C12200, \-ASTM B 152-\ C11000, \-ASME B16.22-\ for Use with Item 5					X	
14	Seamless copper pipe, \-ASTM B 42-\					X	X
15	Cast-bronze threaded fittings, \-ASME B16.15-\ for use with Item 9				X	X	
16	Copper drainage tube, (DWV), \-ASTM B 306-\	X*	X	X*	X	X	
17	Wrought copper and wrought copper alloy solder-joint drainage fittings, \-ASME B16.29-\ for use with Item 12	X	X	X	X	X	
18	Cast-copper alloy solder joint drainage fittings, (DWV), \-ASME B16.23-\ for use with Item 12	X	X	X	X	X	
19	Process glass pipe and fittings, \-ASTM C 1053-\					X	
20	High silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), \-ASTM A 518-\				X	X	
21	Polypropylene (PP) waste pipe and fittings, \-ASTM D 4101-\					X	

22	Filament-wound reinforced thermosetting resin (RTRP) pipe, \-ASTM D 2996-\						X		
23	Acrylonitrile-butadiene-styrene (ABS) plastic drain, waste, and vent pipe and fittings, \-ASTM D 2661-\	X	X	X	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 I

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

		SERVICE							
Item No.	Pipe and Fitting Material	A	B	C	D	E	F	G	H
1	Malleable-iron threaded fittings, galvanized, \-ASME B16.3-\ for use with Item 4	X	X	X					
2	Grooved pipe couplings, ferrous pipe, \-ASTM A 536-\ and \-ASTM A 47-\; non-ferrous pipe, \-ASTM A 536-\ and \-ASTM A 47-\		X	X	X	X	X	X	X
3	Ductile iron grooved joint fittings for ferrous pipe, \-ASTM A 536-\ and \-ASTM A 47-\ for Use with Item 2		X	X	X	X	X	X	X
4	Steel pipe:	X	X	X					
	a. seamless galvanized, \-ASTM A 53-\, Type S, Grade B								
	b. seamless, black, \-ASTM A 53-\, Type S, Grade B				X				
5	Grooved pipe couplings, ferrous pipe, \-ASTM A 536-\ and \-ASTM A 47-\; non-ferrous pipe, \-ASTM A 536-\ and \-ASTM A 47-\		X	X	X	X	X		X

6	Ductile iron grooved joint fittings for ferrous pipe, \-ASTM A 536-\ and \-ASTM A 47-\ for use with Item 5		X	X	X	X	X	X
7	Seamless red brass pipe, \-ASTM B 43-\	X	X					
8	Bronze flanged fittings, \-ASME B16.24-\ for use with Items 5 and 7	X	X					
9	Seamless copper pipe, \-ASTM B 42-\	X	X					
10	Seamless copper water tube, \-ASTM B 88-\	X*	X*	X*	X*	X**		
11	Seamless and welded copper distribution tube (Type D), \-ASTM B 641-\	X	X					
12	Bronze and sand castings grooved joint pressure fittings for non-ferrous pipe, \-ASTM B 584-\ for Use with Item 2		X	X	X	X	X	X
13	Wrought copper grooved joint pressure fittings for non-ferrous pipe, \-ASTM B 75-\, C12200; \-ASTM B 152-\, C11000, \-ASME B16.22-\ for Use with Item 2		X	X	X			X
14	Cast-bronze threaded fittings, \-ASME B16.15-\ for use with Items 5 and 7	X	X					
15	Wrought copper and bronze solder-joint pressure fittings, \-ASME B16.22-\ for use with Items 8 and 9	X	X	X	X	X		
16	Cast-copper alloy solder-joint pressure fittings, \-ASME B16.18-\ for use with Items 8 and 9	X	X	X	X	X		
17	Wrought copper and bronze mechanical-joint 50 mm to 100 mm pressure fittings, \-ASTM B 75-\, C12200; \-ASME B16.22-\ for use with Item 3	X	X		X			
18	Bronze and sand castings mechanical-joint 127 mm to 152 mm pressure fittings, \-ASTM B 584-\, for use with Item 3	X	X		X			

19	Flanges, pipe line, steel, \-MSS SP-44-\	X	X	
20	Unions, \-ASME B16.39-\; brass or bronze, fittings: \-ASME B16.15-\, \-ASME B16.18-\ and \-ASTM B 828-\, Composition B; carbon steel pipe unions socket welding and threaded, \-MSS SP-83-\; malleable-iron threaded union, \-ASME B16.39-\		X	X
21	Nipples, pipe, threaded, \-ASTM A 733-\	X	X	

A - Cold Water Aboveground or Belowground
B - Hot Water 82 degrees C Maximum Aboveground
C - Compressed Air Non-Oil-Free
D - Compressed Medical (Oil-Free) And Vacuum
E - Nitrogen & Oxygen (Gaseous), Nitrous Oxide
F - Distilled Water
G - De-ionized Water
H - Aboveground only

Indicated types are minimum wall thicknesses.
* - Type L Hard
** - Type K Hard

TABLE II

STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE

RATINGS FOR WATER HEATING EQUIPMENT

A. STORAGE WATER HEATERS

FUEL	STORAGE CAPACITY LITERS		INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE
Elect.	454 max		12 kW max	\-10 CFR 430-\	EF = 0.95-0.00132V minimum
Elect.	454 min	OR	12 kW min	\-ASHRAE 90.1-\ (Addenda 90.1b)	SL = 20.45 W/sq. m maximum
Gas	380 max		22 kW max	\-10 CFR 430-\	EF = 0.62-0.0019V minimum
Gas	380 min	OR	22 kW min	\-ANSI Z21.10.3-\	ET = 77 percent; SL = 1.3+38/V maximum
Oil	190 max		30.8 kW max	\-10 CFR 430-\	EF = 0.59-0.0019V minimum
Oil	190 min	OR	30.8 kW max	\-10 CFR 430-\	EC = 83 percent; SL = 1.3+38/V maximum

B. UNFIRED HOT WATER STORAGE, instantaneous water heater, and pool heater.

All volumes and inputs: maximum HL shall be 20.49 W/hr/sq. m.

C. INSTANTANEOUS WATER HEATER

Gas	All	ALL	\-ANSI Z21.10.3-\	ET = 80 percent
Oil	All	ALL	\-ANSI Z21.10.3-\	EC = 83 percent

D. POOL HEATER

Gas or Oil	All	ALL	\-ANSI Z21.56-\	ET = 78 percent

TERMS:

EF = Energy factor, overall efficiency.
ET = Thermal efficiency with 21 degrees C delta T.
EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).
SL = Standby loss in W/sq. m. based on 27 degrees C delta T, or in percent per hour based on nominal 32 degree C delta T.
HL = Heat loss of tank surface area

V = Storage volume in liters

3.20 FRAMED INSTRUCTIONS

3.20.1 Framed Instructions

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.20.2 Framed Valve Chart.

Framed valve chart under glass or in plastic laminate, including all valves required by this specification section and their location shall be posted at each access to crawl space and in each mechanical room. Framed Valve Chart shall be posted before acceptance testing of the systems.

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