US Army Corps
of Engineers
Savannah District

# Hunter Army Airfield
# Georgia

**Invitation for Bid**
**DACA21-98-B-0017**
**SOF Company Administration Facility**
**FY-98, Line Item 0371770**
**Volume II of III**
**Divisions 1 through 13**
**February 1998**

**THIS SOLICITATION IS RESTRICTED TO 8(a) CONTRACTORS IN THE STATE OF GEORGIA FOR COMPETITIVE BIDDING PURSUANT TO THE "BUSINESS OPPORTUNITY DEVELOPMENT REFORM ACT OF 1988" (PUBLIC LAW 100-656, SECTION 303(b))**

**U.S. ARMY ENGINEER DISTRICT, SAVANNAH**
**CORPS OF ENGINEERS**
**100 WEST OGLETHORPE AVENUE**
**SAVANNAH, GEORGIA 31401-3640**

# TABLE OF CONTENTS
# DIVISIONS 1 THROUGH 13
# VOLUME II

**Division 1 - General Requirements**
Section 01030 - Metric Measurements
Section 01090 - Sources for Reference Publications
Section 01300 - Submittal Procedures
Section 01440 - Contractor Quality Control
Section 01500 - Temporary Construction Facilities

**Division 2 - Site Work**
Section 02012 - Environmental Protection
Section 02050 - Demolition
Section 02059 - Removal of Building Foundations, Pavements, and Drainage Structures
Section 02110 - Clearing and Grubbing
Section 02210 - Grading
Section 02221 - Excavation, Filling and Backfilling for Buildings
Section 02222A- Excavation, Trenching and Backfilling for Utilities Systems
Section 02233 - Graded-Crushed-Aggregate Base Course
Section 02285 - Soil Treatment for Subterranean Termite Control
Section 02511 - Concrete Sidewalks and Curbs and Gutters
Section 02550 - Bituminous Pavement
Section 02580 - Pavement Markings
Section 02660 - Water Distribution System
Section 02698 - Prefabricated Underground/Cooling Distribution System
Section 02720 - Storm-Drainage System
Section 02730 - Sanitary Sewers
Section 02811 - Underground Sprinkler Systems
Section 02831 - Chain Link Fence
Section 02935 - Turf
Section 02950 - Trees, Shrubs, Ground Covers and Vines

**Division 3 - Concrete**
Section 03100 - Structural Concrete Formwork
Section 03300 - Cast-in-Place Structural Concrete

**Division 4 - Masonry**
Section 04200 - Masonry

**Division 5 - Metals**
Section 05120 - Structural Steel
Section 05210 - Steel Joists
Section 05300 - Steel Decking
Section 05450 - Pre-Engineered Light Gauge Steel Trussed Frames
Section 05500 - Miscellaneous Steel

**Division 6 - Wood and Plastics**
Section 06100 - Rough Carpentry
Section 06200 - Finish Carpentry

**Division 7 - Thermal and Moisture Protection**
Section 07160 - Bituminous Dampproofing
Section 07220 - Roof Insulation
Section 07270 - Firestopping
Section 07413 - Metal Roofing and Siding
Section 07600 - Sheet Metalwork, General
Section 07920 - Joint Sealing

**TABLE OF CONTENTS**
**DIVISIONS 1 THROUGH 13**
**VOLUME II (continued)**

**Division 8 - Doors and Windows**
Section 08110 - Steel Doors and Frames
Section 08120 - Aluminum Doors and Frames
Section 08201 - Wood Doors
Section 08318 - Security-Vault Door
Section 08330 - Overhead Rolling Doors
Section 08520 - Aluminum Windows
Section 08700 - Door Hardware
Section 08810 - Glass and Glazing

**Division 9 - Finishes**
Section 09250 - Gypsum Wallboard
Section 09310 - Ceramic Tile
Section 09510 - Acoustical Ceilings
Section 09650 - Resilient Flooring
Section 09680 - Carpet
Section 09900 - Painting
Section 09915 - Color Schedule
Section 09950 - Wall Coverings

**Division 10 - Specialities**
Section 10160 - Toilet Partitions
Section 10260 - Wall and Corner Protection
Section 10430 - Exterior Signage
Section 10440 - Interior Signage
Section 10800 - Toilet Accessories

**Division 12 - Furnishings**
Section 12390 - Cabinets and Countertops
Section 12540 - Window Blinds, Shades, and Drapery Hardware

**Division 13 - Special Construction**
Section 13080 - Seismic Protection for Mechanical, Elelctrical Equipment
Section 13814 - Building Preparation for Energy Monitoring and Control Systems (EMCS)

SECTION 01030

METRIC MEASUREMENTS

## 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 380 (1993) Practice for Use of the International System of Units (SI)

ASTM E 621 (1984; R 1991) Practice forUse of Metric (SI) Units in Building Design and Construction

## 1.2 GENERAL

This project includes metric units of measurements. The metric units used are the International System of Units (SI) developed and maintained by the General Conference on Weights and Measures (CGPM); the name International System of Units and the international abbreviation SI were adopted by the 11th CGPM in 1960. In some cases both metric SI units and English inch-pound (I-P) units are included in a section of the specifications; the measurements used in any particular case have been determined by the circumstances involved. Specifications requiring metric measurements may contain requirements for equipment (e.g. printers, HVAC systems) described in I-P units; in which case no metric substitution will be allowed. Specifications requiring metric measurements may include references to related non-metric industry and/or Government standards; in which case the requirements of the standard govern.

## 1.3 USE OF MEASUREMENTS

Measurements shall be either in SI or I-P units as indicated, except for soft metric measurements or as otherwise authorized. The Contractor shall be responsible for all associated labor and materials when authorized to substitute one system of units for another and for the final assembly and performance of the specified work and/or products.

### 1.3.1 Hard Metric

A hard metric measurement is indicated by an SI value with no expressed correlation to an I-P value (e.g. 38 mm. Hard metric measurements are often used for field data such as distance from one point to another or distance above the floor. Products are considered to be hard metric when they are manufactured to metric dimensions or have an industry recognized metric designation.

### 1.3.2 Soft Metric

A soft metric measurement is indicated by an SI value which is a mathematical approximation of the I-P value shown in parentheses (e.g. 38.1 mm (1-1/2 inches)). Soft metric measurements are used for measurements pertaining to products, test values, and other situations where the I-P units are the standard for manufacture, verification, or other controlling factor. The I-P value shall govern while the metric measurement is provided for information.

### 1.3.3 Neutral

A neutral measurement is indicated by an identifier which has no expressed relation to either an SI or an I-P value (e.g. American Wire Gage (AWG) which indicates thickness but in itself is neither SI nor I-P).

## 1.4 COORDINATION

Discrepancies, such as mismatches or product unavailability, arising from use of both metric and non-metric measurements and discrepancies between the measurements in the specifications and the measurements in the drawings shall be brought to the attention of the Contracting Officer for resolution.

## 1.5 RELATIONSHIP TO SUBMITTALS

Submittals for Government approval or for information only shall cover the SI or I-P products actually being furnished for the project. The Contractor shall submit the required drawings and calculations in the same units used in the contract documents describing the product or requirement unless otherwise instructed or approved. The Contractor shall use ASTM E 380 and ASTM E 621 as the basis for establishing metric measurements required to be used in submittals.

-- End of Section --

SECTION 01090

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

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

AGRICULTURAL MARKETING SERVICE (AMS)
Seed Regulatory and Testing Branch
USDA, AMS, LS Div.
Bldg. 506, BARC-East
Soil Conservation Rd.
Beltsville, MD 20705
Ph: 301-504-9430

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

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

AIR DIFFUSION COUNCIL (ADC)
One Ill. Ctr #200
111 E. Wacker Dr.
Chicago, IL 60601
Ph: 312-616-0800

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

ALUMINUM ASSOCIATION (AA)
P.O. Box 753
Waldorf, MD 20601
Ph: 301-645-0756
Fax: 301-843-0159

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1540 East Dundee Rd., Suite 310
Palatine, IL 60067-8321
Ph: 708-202-1350
Fax: 708-202-1480

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 N. Capital, NW, Suite 225
Washington, DC  20001
Ph:  202-624-5809
Fax:  202-624-5806

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)
P.O. Box 12215
Research Triangle Park, NC  27709-2215
Ph:  919-549-8141
Fax:  919-549-8933

AMERICAN BOILER MANUFACTURERS ASSOCIATION (ABMA)
950 N. Glebe Rd., Suite 160
Arlington, VA  22203
Ph:  703-522-7350
Fax:  703-522-2665

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

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)
8300 Boone Blvd., #400
Vienna, VA  22182
Ph:  703-821-1990
Fax:  703-821-3054

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
650 Glenway Ave., Bldg. D-7
Cincinnati, OH  45211-4438
Ph:  513-661-7881
Fax:  513-661-7195

AMERICAN GAS ASSOCIATION (AGA)
1515 Wilson Blvd.
Arlington, VA  22209
Ph:  703-841-8400
Fax:  703-841-8406

AMERICAN GAS ASSOCIATION LABORATORIES (AGAL)
8501 East Pleasant Valley Rd.
Cleveland, OH  44131
Ph:  216-524-4990
Fax:  216-642-3463

AMERICAN GEAR MANUFACTURERS ASSOCIATION (AGMA)
1500 King St., Suite 201
Alexandria, VA  22314
Ph:  703-684-0211

Fax: 703-684-0242

AMERICAN HARDBOARD ASSOCIATION (AHA)
1210 W. Northwest Highway
Palatine, IL 60067
Ph: 708-934-8800
Fax: 708-934-8803

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

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)
11818 SE Mill Plain Blvd., Suite 407
Vancouver, WA 98684
Ph: 206-254-9132
Fax: 202-254-9456

AMERICAN IRON AND STEEL INSTITUTE (AISI)
1101 Seventeenth St., NW, Suite 1300
Washington, DC 20036
Ph: 202-452-7100
Fax: 202-463-6573

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

AMERICAN PETROLEUM INSTITUTE (API)
1220 L St., NW
Washington, DC 20005
Ph: 202-682-8375
Fax: 202-962-4776

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

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)
50 F St., NW, Suite 7702
Washington, DC 20001
Ph: 202-639-2190
Fax: 202-639-2283

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

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

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
United Engineering Center
345 East 47th St.
New York, NY  10017
Ph:  212-705-7946
Fax:  212-980-4681

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

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

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

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

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

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)
P.O. Box 286
Woodstock, MD  21163-0286
Ph:  410-465-3169
Fax:  410-465-3195

ANTI-FRICTION BEARING MANUFACTURERS ASSOCIATION (AFBMA)
1101 Connecticut Ave., NW, Suite 700
Washington, DC  20036
Ph:  202-429-5155
Fax:  202-223-4579

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

ASBESTOS CEMENT PIPE PRODUCERS ASSOCIATION (ACPPA)
1745 Jefferson Davis Highway, Suite 406
Arlington, VA  22202
Ph:  703-412-1153
Fax:  703-412-1152

ASM INTERNATIONAL (ASM)
Materials Park, OH  44073
Ph:  216-338-5151

ASPHALT INSTITUTE (AI)
Research Park Dr.
P.O. Box 14052
Lexington, KY  40512-4052
Ph:  606-288-4960
Fax:  606-288-4999

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

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)
600 No. 18th St.
P.O. Box 2641
Birmingham, AL  35291-0992
Ph:  205-250-2530
Fax:  205-250-2540

ASSOCIATION OF HOME APPLIANCE MANUFACTURERS (AHAM)
20 No.Wacker Dr.
Chicago, IL  60606
Ph:  312-984-5800
Fax:  312-984-5823

ASSOCIATION OF IRON AND STEEL ENGINEERS (AISE)
Three Gateway Center, Suite 2350
Pittsburgh, PA  15222
Ph:  412-281-6323
Fax:  412-286-4657

BELLCORE (BELLCORE)
ATTN:  Customer Service
60 New England Ave.
Piscataway, NJ  08854
Ph:  800-521-2673
      or
     908-699-2000
Fax: 908-336-2559

BRICK INSTITUTE OF AMERICA (BIA)
11490 Commerce Park Dr., Suite 308
Reston, VA  22091
Ph:  703-620-0010

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

BUILDING OFFICIALS & CODE ADMINISTRATORS INTERNATIONAL (BOCA)
4051 W. Flossmoor Rd.
Country Club Hills, IL  60478-5795
Ph:  708-799-2300

BUREAU OF RECLAMATION (BOR)
Dept. of the Interior
P.O. Box 25007
Denver, CO  80225
Ph:  303-236-6741

CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)
Publication Distribution Unit
1900 Royal Oaks Dr.
Sacramento, CA  95815
Ph:  916-445-3520
Fax:  916-324-8997

CALIFORNIA REDWOOD ASSOCIATION (CRA)
405 Enfrente Ave., Suite 200
Novato, CA  94949
Ph:  415-382-0662
Fax:  415-382-8531

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

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

CEILINGS & INTERIOR SYSTEMS CONTRACTORS ASSOCIATION (CISCA)
579 West North Ave.
Elmhurst, IL  60126
Ph:  708-833-1919
Fax:  708-883-1940

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

CODE OF FEDERAL REGULATIONS (CFR)
Order from:
Government Printing Office
Washington, DC  20402
Ph:  202-783-3238
Fax:  202-275-7703

COMMERCIAL ITEM DESCRIPTIONS (CID)
Order from:
Standardization Documents Order Desk
Bldg 4D
700 Robbins Av
Philadelphia, PA  19111-5094
Ph:  215-697-2179
Fax:  215-697-2978
      or

General Services Administration
Specifications Section
7th and D Street, SW, Room 6654
Washington, DC  20407
Ph:  202-708-9205
Fax:  202-708-9862

COMMISSION INTERNATIONALE DE L'ECLAIRAGE (CIE) USNC/CIE
c/o TLA - Lighting Consultants, Inc.
7 Pond St.
Salem, MA  01970
Ph:  508-745-6870

COMPRESSED GAS ASSOCIATION (CGA)
Crystal Gateway 1, Suite 501
1725 Jefferson Davis Highway, #1004
Arlington, VA  22202-4102
Ph:  703-979-0900
Fax:  703-979-0134

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

CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION (CEMA)
932 Hungerford Dr., #36
Rockville, MD  20850
Ph:  301-738-2448
Fax:  301-738-0076

COOLING TOWER INSTITUTE (CTI)
P.O. Box 73383
Houston, TX  77273
Ph:  713-583-4087
Fax:  713-563-1721

COPPER DEVELOPMENT ASSOCIATION (CDA)
260 Madison Ave.
New York, NY 10016
Ph:  212-251-7200
Fax:  212-251-7234

CORPS OF ENGINEERS (COE)
Order from:
U.S. Army Engineer Waterways Experiment Station
ATTN:  Technical Report Distribution Section, Services Branch, TIC
3909 Halls Ferry Rd.
Vicksburg, MS  39180-6199
Ph:  601-634-2355
Fax:  601-634-2506

DEFENSE INFORMATION SYSTEMS AGENCY (DISA)
Code:  BIAR
A Street and So. Courthouse Rd.
Arlington, VA  22204-2199
Ph:  703-692-6965

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

DEPARTMENT OF DEFENSE (DOD)
Order from:
Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, PA 19120-5099
Ph:  215-697-2179 (Govt)
215-697-3321 (Industry)

DEPARTMENT OF STATE (SD)
ATTN:  DS/PSP/SEP
SA-6, Room 804
Washington, DC 20522-0602
Ph:  703-875-6537

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

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

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)
Order From:
Global Engineering Documents
7730 Carondelet Av., Suite 407
Clayton, MO 63105
Ph:  800-854-7179
Fax:  314-726-6418

ENVIRONMENTAL PROTECTION AGENCY (EPA)
Public Information Center
401 M St., SW
Washington, DC  20460
Ph:  202-260-7751
Order From:
Superintendent of Documents
Government Printing Office
Washington, DC  20402-9325
Ph:  202-783-3238
Fax:  202-275-7703

EXPANSION JOINT MANUFACTURERS ASSOCIATION (EJMA)
25 No. Broadway
Tarrytown, NY  10591
Ph:  914-332-0040

EXTERIOR INSULATION MANUFACTURERS ASSOCIATION (EIMA)
2759 State Rd. 580 Suite 112
Clearwater, FL  34621
Ph:  813-726-6477
Fax:  813-726-8180

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

FEDERAL AVIATION ADMINISTRATION (FAA)
Order from:
Superintendent of Documents
Government Printing Office
Washington, DC  20402-9371
Ph:  202-783-3238
Fax:  202-512-2750
or
Dept. of Transportation
ATTN:  M443.2
400 Seventh St., SW
Washington, DC  20590
Ph:  202-366-4000

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)
P. O. Box 70274
Washington, DC  20024
Ph:  202-646-3484

FEDERAL HIGHWAY ADMINISTRATION (FHWA)
Office of Highway Safety (HHS-31)
400 Seventh St., SW
Washington, DC  20590-0001
Ph:  202-366-0411
Fax:  202-366-2249
Order from:
Government Printing Office
Superintendent of Documents
Washington, DC  20402
Ph:  202-783-3238

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

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

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

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

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCHR) USC
KAP-200 University Park MC-2531
Los Angeles, CA  90089-2531
Ph:  213-740-2032
Fax:  213-740-8399

GENERAL SERVICES ADMINISTRATION (GSA)
Order from:
GSA  FSS/3FNHF-Co
Crystal Mall 4, Room 403
Washington, DC  20406
Ph:  703-305-6016
Fax:  703-305-6290

GERMANY INSTITUTE FOR STANDARDIZATION (DIN)
Order from:
Global Engineering Documents
2805 McGaw Ave.
Irvine, CA  92714
Ph:  800-854-7179
      or
     714-261-1455
Fax: 314-726-6418

GYPSUM ASSOCIATION (GA)
810 First St. NE, Suite 510
Washington, DC 20002
Ph:  202-289-5440
Fax: 202-289-3707

HARDWOOD PLYWOOD MANUFACTURERS ASSOCIATION (HPMA)
1825 Michael Faraday Dr.
P.O. Box 2789
Reston, VA  22090-2789
Ph:  202-435-2900
Fax:  703-435-2537

HEAT EXCHANGE INSTITUTE (HEI)
1300 Sumner Ave
Cleveland, OH  44115-2851
Ph:  216-241-7333
Fax:  216-241-0105

H.P. WHITE LABORATORY (HPW)
3114 Scarboro Rd.
Street, MD  21154
Ph:  301-838-6550

HYDRAULIC INSTITUTE (HI)
9 Sylvan Way, Suite 180
Parsippany, NJ  07054-3802
Ph:  201-267-9700
Fax:  201-267-9055

HYDRONICS INSTITUTE (HYI)
35 Russo Pl.
Berkeley Heights, NJ  07922
Ph:  908-464-8200
Fax:  908-464-7818

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IES)
345 East 47th St.
New York, NY  10017
Ph:  212-705-7925
Fax:  212-705-7641

INDUSTRIAL FASTENERS INSTITUTE (IFI)
1105 East Ohio Bldg.
1717 East 9th St.
Cleveland, OH  44114
Ph:  216-241-1482

INSTITUTE FOR INTERCONNECTING AND PACKAGING ELECTRONIC CIRCUITS (IPC)
7380 N. Lincoln Ave.
Lincolnwood, IL  60646
Ph:  708-677-2850

INSTITUTE OF CLEAN AIR COMPANIES (ICAC)
1707 L St., NW, Suite 570
Washington, DC  20036-4201
Ph:  202-457-0911
Fax:  202-331-1388

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

INSTRUMENT SOCIETY OF AMERICA (ISA)
P.O. Box 3561
Durham, NC  27702
Ph:  919-549-8411
Fax:  919-549-8288

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
P.O. Box 440
South Yarmouth, MA  02664
Ph:  508-394-4424
Fax:  508-394-1194

Order From:
American National Standards Institute
Customer Service Dept.
1430 Broadway
New York, NY 10018
Ph: 212-642-4900
Fax: 212-302-1286

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)
20001 Walnut Dr., So.
Walnut, CA 91789-2825
Ph: 714-595-8449
Fax: 714-594-3690

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)
5360 So. Workman Mill Rd.
Whittier, CA 90601-2258
Ph: 310-692-4226
Fax: 310-692-3853

INTERNATIONAL INSTITUTE OF AMMONIA REFRIGERATION (IIAR)
1101 Connecticut Ave., NW, Suite 700
Washington, DC 20036
Ph: 202-857-1110

INTERNATIONAL MUNICIPAL SIGNAL ASSOCIATION (IMSA)
P.O. Box 539
Newark, NJ 14513
Ph: 315-331-2182
Fax: 315-331-8505

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)
Order from:
American National Standards Institute
1430 Broadway
New York, NY 10018
Ph: 212-642-4900
Fax: 212-302-1286

INTERNATIONAL SLURRY SURFACING ASSOCIATION (ISSA)
1101 Connecticut Ave., NW, Suite 700
Washington, DC 20036
Ph: 202-857-1160
Fax: 202-223-4579

INTERNATIONAL TELEGRAPH AND TELEPHONE CONSULTATIVE COMMITTEE (CCITT)
Order from:
U.S. Dept of Commerce
National Technical Information Service
585 Port Royal Road.
Springfield, VA 22161
Ph: 703-487-4660

IRON AND STEEL SOCIETY (ISS)
410 Commonwealth Dr.
Warrendale, PA 15086-7512
Ph: 412-776-9460
Fax: 412-776-0430

KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)
1899 Preston White Dr.
Reston, VA  22091-4326
Ph:  703-264-1690
Fax:  703-620-6530

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

MAPLE FLOORING MANUFACTURERS ASSOCIATION (MFMA)
60 Revere Dr., Suite 500
Northbrook, IL  60062
Ph:  312-480-9080
Fax:  708-480-9282

MARBLE INSTITUTE OF AMERICA (MIA)
3305 State St.
Farmington, MI  48335
Ph:  313-476-5558
Fax:  313-476-1630

MATERIAL HANDLING INSTITUTE (MHI)
8720 Red Oak Blvd., Suite 201
Charlotte, NC  28217
Ph:  704-522-8644
Fax:  704-522-7826

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)
1300 Sumner Ave.
Cleveland, OH  44115-2851
Ph:  216-241-7333
Fax:  216-241-0105

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)
2017 So. 139th Cir.
Omaha, NE  68144
Ph:  402-342-3463

MILITARY HANDBOOKS (MIL-HDBK)
Order from:
Standardization Documents Order Desk
Bldg 4D
700 Robbins AV
Philadelphia, PA 19111-5094
Ph:  215-697-2179
Fax:  215-697-2978

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

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

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)
600 So. Federal St., Suite 400
Chicago, IL 60605
Ph: 312-922-6222
FAX: 312-922-2734

NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE)
P.O. Box 218340
Houston, TX 77218-8340
Ph: 713-492-0535
Fax: 713-492-8254

NATIONAL ASSOCIATION OF GARAGE DOOR MANUFACTURERS (NAGDM)
1300 Sumner Avenue
Cleveland, OH 44115
Ph: 216-241-7333
Fax: 216-241-0105

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

NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS (NBBPVI)
1055 Crupper Ave.
Columbus, OH 43229
Ph: 614-888-8320
Fax: 614-847-1828

NATIONAL CABLE TELEVISION ASSOCIATION (NCTA)
1724 Massachusetts Ave. NW
Washington, DC 20036-1969
Ph: 202-775-3637
Fax: 202-775-3698

NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS (NCRP)
7910 Woodmont Ave., Suite 800
Bethesda, MD 20814
Ph: 301-657-2652
Fax: 301-907-8768

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

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)
1385 Piccard Dr.
Rockville, MD 20850-4340
Ph: 301-977-3698
Fax: 301-977-9589

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

NATIONAL FLUID POWER ASSOCIATION (NFLPA)
3333 No. Mayfair Rd.
Milwaukee, WI 53222
Ph: 414-778-3344

NATIONAL FOREST PRODUCTS ASSOCIATION (NFOPA)
1250 Connecticut Ave., NW, Suite 200
Washington, DC 20036
Ph: 202-463-2765
Fax: 202-463-2791

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)
P.O. Box 34518
Memphis, TN 38134
Ph: 901-377-1818
Fax: 901-382-6419

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)
200 Independence Ave., SW
Washington, DC 20201
Ph: 800-356-4674; 202-472-7134
Order from:
Superintendent of Documents
Government Printing Office
Washington, DC 20402-9325
Ph: 202-783-3238
Fax: 202-275-7703

NATIONAL INSTITUTE OF JUSTICE (NIJ)
TAPIC
1600 Research Blvd.
Rockville, MD 20850
Ph: 800-248-2742

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

NATIONAL LIME ASSOCIATION (NLA)
3601 No. Fairfax Dr.
Arlington, VA 22201
Ph: 703-243-5463
Fax: 703-243-5489

NATIONAL OAK FLOORING MANUFACTURERS ASSOCIATION (NOFMA)
P.O. Box 3009
Memphis, TN 38173-0009
Ph: 901-526-5016

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)
900 Spring St.
Silver Spring, MD  20910
Ph:  301-587-1400
Fax:  301-585-4219

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)
P.O. Box 4752
Carol Stream, IL  60197-4752
Ph:  800-323-9545
Fax:  708-299-1183

NATIONAL TERRAZZO & MOSAIC ASSOCIATION (NTMA)
3166 Des Plaines Ave., Suite 132
Des Plaines, IL  60018
Ph:  800-323-9736
Fax:  708-635-9127

NATIONAL WOOD WINDOW & DOOR ASSOCIATION (NWWDA)
1400 East Touhy Ave., Suite G-54
Des Plaines, IL  60018
Ph:  708-299-5200
Fax:  708-299-1286

NAVAL CIVIL ENGINEERING LABORATORY (NCEL)
Code L34
Port Hueneme, CA  93043-5003
Ph:  805-982-1694
Fax:  805-982-1694

NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)
200 Stovall St.
Code DSO-2
Alexandria, VA 22332-2300
Ph:  703-325-0450
Fax:  703-325-1916

NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION (NAIMA)
44 Canal Center Plaza, Suite 310
Alexandria, VA  22314
Ph:  703-684-0084

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)
P.O. Box 87A
Cumberland Center, ME  04021
Ph:  207-829-6901
Fax:  207-829-6901

NSF INTERNATIONAL (NSF)
3475 Plymouth Rd.
P.O. Box 130140
Ann Arbor, MI  48113-0140
Ph:  313-769-8010
Fax:  313-769-0109

PIPE FABRICATION INSTITUTE (PFI)
P.O. Box 173
Springdale, PA  15144
Ph:  412-274-4722
Fax:  412-274-4722

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

PLUMBING AND PIPING INDUSTRY COUNCIL (PPIC)
501 Shatto Place, Suite 402
Los Angeles, CA  90020
Ph:  213-487-3790
Fax:  213-487-3880

PORCELAIN ENAMEL INSTITUTE (PEI)
1101 Connecticut Ave. NW, Suite 700
Washington, DC  20036
Ph:  202-857-1134
Fax:  202-223-4579

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

RUBBER MANUFACTURERS ASSOCIATION (RMA)
1400 K St., NW
Washington, DC  20005
Ph:  202-682-4800

RURAL ELECTRIFICATION ADMINISTRATION (REA)
Order from:
USDA-REA-ASD
ATTN:  Publications
14th and Independence Ave., SW, Room 0180
Washington, DC  20250
Ph:  202-720-8674

SCIENTIFIC APPARATUS MAKERS ASSOCIATION (SAMA)
Order from:
American National Standards Institute (ANSI)
11 West 42nd St.
New York, NY  10036
Ph:  212-642-4900
Fax:  212-302-1286

SCREEN MANUFACTURERS ASSOCIATION (SMA)
655 Irving Park, Lake Shore Dr., Suite 201
Chicago, IL  60613-3198
Ph:  312-525-2644
Fax:  312-248-9659

SEALANT WATERPROOFING INSTITUTE (SWRI)
3101 Broadway, Suite 585
Kansas City, MO  64111
Ph:  816-561-8230
Fax:  816-561-7765

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

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)
400 Commonwealth Dr.
Warrendale, PA  15096-0001
Ph:  412-776-4970
Fax:  412-776-0790

SOLAR RATING AND CERTIFICATION CORPORATION (SRCC)
777 No. Capitol St., Suite 805
Washington, DC  20002
Ph:  202-408-0306
Fax:  202-408-8563

SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL (SBCCI)
900 Montclair Road
Birmingham, AL  35213
Ph:  205-591-1853
Fax:  205-592-7001

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)
400 Penn Center Blvd.,
Suite 530
Pittsburgh, PA  15235
Ph:  412-829-0770
Fax:  412-829-0844

SOUTHERN PINE INSPECTION BUREAU (SPIB)
4709 Scenic Highway
Pensacola, FL  32504-9094
Ph:  904-434-2611
Fax:  904-433-5594

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

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

STEEL JOIST INSTITUTE (SJI)
1205 Forty-eighth Ave. No., Suite A
Myrtle Beach, SC  29577
Ph:  803-449-0487
Fax:  803-449-1343

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

STEEL TANK INSTITUTE (STI)
570 Oakwood Rd.
Lake Zurich, IL  60047
Ph:  708-438-0989
       800-275-1300
Fax:  708-438-4509

STEEL WINDOW INSTITUTE (SWI)
1300 Sumner Ave.
Cleveland, OH  44115-2851
Ph:  216-241-7333
Fax:  216-241-0105

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)
P.O. Box 105113
Atlanta, GA  30348-5113
Ph:  800-332-8686; 404-446-1400
Fax:  404-446-5113

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

TRUSS PLATE INSTITUTE (TPI)
583 D'Onofrio Dr., Suite 200
Madison, WI  53719
Ph:  608-833-5900
Fax:  608-833-4360

TUBULAR EXCHANGER MANUFACTURERS ASSOCIATION (TEMA)
25 No. Broadway
Tarrytown, NY 10591
Ph:  914-332-0040
Fax:  914-332-1541

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

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)
2655 Villa Creek Dr., Suite 155
Dallas, TX  75234
Ph:  214-253-3902
Fax:  214-243-3907

WATER POLLUTION CONTROL FEDERATION (WPCF)
601 Wythe St.
Alexandria, VA  22314-1994
Ph:  703-684-2400

WATER QUALITY ASSOCIATION (WQA)
4151 Naperville Rd.
Lisle, IL  60532
Ph:  708-505-0160
Fax:  708-505-9637

WELDING RESEARCH COUNCIL (WRC)
345 East 47th St.
New York, NY  10017
Ph:  212-705-7956
Fax:  212-371-9622

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

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

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

-- End of Section --

*12

SECTION 01110

SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW)

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 (Most current edition.) | Threshold Limit Values for Chemical Substances and Physical Agents andBiological Exposure Indices |

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

| | |
|---|---|
| ANSI Z358.1 | (1990) Emergency Eyewash and Shower Equipment |

CODE OF FEDERAL REGULATIONS (CFR)

| | |
|---|---|
| CFR 29 Part 1904 | Recording and Reporting Occupational Injuries and Illnesses |
| CFR 29 Part 1910 | Occupational Safety and Health Standards |
| CFR 29 Part 1926 | Safety and Health Regulations for Construction |
| CFR 49 Part 171 | General Information, Regulations, and Definitions |
| CFR 49 Part 172 | Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements |

ENGINEERING MANUALS

| | |
|---|---|
| EM 385-1-1 | (1996) US Army Corps of Engineers Safety and Health Requirements Manual |

FEDERAL ACQUISITION REGULATIONS (FAR)

Federal Acquisition Regulations, Clause 52.236-13: Accident Prevention

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

| | |
|---|---|
| NIOSH Pub No. 85-115 | (1985) Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities |

1.2 DESCRIPTION OF WORK

1.2.1 Site History

The SOF Building construction site is located at the corner of Strachan and Douglas Streets at Hunter Army Airfield (HAAF), Savannah, Georgia. The site is currently covered with asphalt and is used as a POV parking lot associated

with existing buildings. The site is generally flat with a few large oak and palm trees. Several buildings are located around the periphery of the site. Immediately south of the site is the airfield with several vehicle maintenance shops and to the east is an old photograph printing shop. Several old WWII-era barracks are located north and west of the site. There is a possibility that some hydrocarbon contamination exists in the subsurface at this site. This information is derived from previous investigations in and around the site area. In the event that contaminated soil is encountered during construction activities or if dewatering activities occur this section will become applicable to any and all remedial actions taken. In order to insure that contaminated soil is identified correctly and in the interest of construction worker safety at the site, the contractor shall conduct continual on-site air monitoring utilizing at least two of the following real time instruments (making sure that the solvents identified in section 1.8.1.1.1 of this specification will be accurately monitored):

Flame Ionization Detector (FID)
Photo Ionization Detector (PID)
Combination FID/PID Instrument and
Combustible Gas Indicator (CGI) and
Hand pump and detector tubes for benzene

The contractor shall also require workers at the site to closely observe standards of personal hygiene in addition to wearing chemically resistant gloves to avoid potential dermal contact.

The following action levels shall be adhered to during air monitoring:

Combustible Gas Indicator (CGI) Action Levels: Taken immediately above (within 6 inches) of the excavation (Also note that an excavation may qualify as a confined space and if so, must be treated as such).

Lower Explosive Limit is 20% and rising. Evacuate area until levels drop below 20%.

1.3 SUBMITTALS

1.3.1 Drawings

Drawings shall be submitted which show the following:

Work Zones; (GA)

Drawings shall include initial work zone boundaries: Exclusion Zone (EZ), including restricted and regulated areas; Contamination Reduction Zone (CRZ); and Support Zone (SZ) and show the layout of the personnel and equipment decontamination areas. These need not be full size and may be submitted separately or appended to the Site Safety and Health Plan (SSHP). The zones and decontamination areas must be accepted by the Contracting officer (CO).
Decon Facilities (GA)
Representative layout for personnel and equipment decontamination, as specified.

1.3.2 Reports (FIO)

The following types of information generated in the field during execution of this project shall be submitted as attachments to the biweekly report.

Monitoring/Sampling Results;

Personnel exposure monitoring/sampling results as generated by direct reading instruments and personal monitoring shall be submitted. Reports shall include date, time, worker name, task and instrument. Negative readings shall also be submitted

Site Control Log (FIO)

Record of each entry and exit into the site, as specified.

Inspections/Daily Safety Log (FIO)
Submit records as specified.

Safety & Health Phase Out Report (FIO)
Submit as specified.

1.3.3 Documents (GA)

Site Safety and Health Plan (SSHP)
Draft: a minimum of 4 copies provided to the government for review. Final: a minimum of 4 copies provided to the government for review. Addendums: a minimum of 3 copies provided to the government for review), all as specified.

Training and Medical Certificates (FIO)
Certifications for Contractor and subcontractor personnel, to be included with SSHP, as specified.

1.4 REGULATORY REQUIREMENTS

Work performed under this contract shall comply with EM 385-1-1, applicable Federal, state, and local safety and occupational health laws and regulations. This includes, but is not limited to, Occupational Safety and Health Administration (OSHA) standards, CFR 29 Part 1910, especially Section .120, "Hazardous Waste Site Operations and Emergency Response" and CFR 29 Part 1926, especially Sections .62 Lead in Construction (if necessary) and .65, "Hazardous Waste Site Operations and Emergency Response". Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.5 PRECONSTRUCTION SAFETY CONFERENCE

Unless otherwise agreed upon by the Contracting Officer, the preconstruction safety conference will be included with the general preconstruction meeting.

1.6 SAFETY AND HEALTH PROGRAM

OSHA Standards CFR 29 Part 1910, Section .120 (b) and CFR 29 Part 1926, Section .65 (b) require employers to develop and implement a written Safety and Health Program for employees involved in hazardous waste operations. These standards will be considered as applicable to the site under this contract. The site-specific program requirements of these OSHA Standards shall be integrated into one site-specific document, the Site Safety and Health Plan (SSHP). The SSHP shall interface with the employer's overall Safety and Health Program. Any portions of the overall Safety and Health Program that are referenced in the SSHP shall be included as appendices to the SSHP.

1.7 SITE SAFETY AND HEALTH PLAN

### 1.7.1 Preparation and Implementation

A Site Specific Safety and Health Plan (SSHP) shall be prepared (using ER 385-1-92 18 March 1994 in addition to references listed in section 1.1) covering onsite work to be performed by the Contractor and all subcontractors. The Safety and Health Manager (Certified Industrial Hygienist (CIH)) shall be responsible for the development, implementation and oversight of the SSHP. The SSHP shall establish, in detail, the protocols necessary for the anticipation, recognition, evaluation, and control of hazards associated with each task performed. The SSHP shall address site-specific safety and health requirements and procedures based upon site-specific conditions. The level of detail provided in the SSHP shall be tailored to the type of work, complexity of operations to be performed, and hazards anticipated. Details about some activities may not be available when the initial SSHP is prepared and submitted. Therefore, the SSHP shall address, in as much detail as possible, anticipated tasks, their related hazards and anticipated control measures. Additional details shall be included in the activity hazard analyses as described in paragraph: 1.10 ACTIVITY HAZARD ANALYSES.

### 1.7.2 Acceptance and Modifications (SSHP Addendums)

Prior to submittal, the SSHP shall be signed and dated by the Safety and Health Manager (CIH) and the Site Superintendent. The SSHP shall be submitted for review 15 days after the Notice to Proceed (NTP). Deficiencies in the SSHP shall be addressed. Items corrected in the SSHP shall be annotated by page, section, and change description. Each review comment shall be answered and shall correspond to the original comment, suggestion, or deficiency remark. These responses may be combined in one document for review and acceptance. The document shall include the contract’s name, number and date of the submittal. Onsite work shall not begin until the plan has been accepted. A copy of the written SSHP shall be maintained onsite. As work proceeds, the SSHP shall be adapted to new situations and new conditions. Changes and modifications to the accepted SSHP shall be made with the knowledge and concurrence of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer. Should any modifications or changes be made that are not included in the original accepted SSHP, sequentially numbered addendums shall be submitted for review and acceptance (GA). All addendums shall be reviewed, dated and signed by the CIH. The addendums, along with the approved SSHP will then comprise the SSHP. Should any unforeseen hazard become evident during the performance of the work, the Site Safety and Health Officer (SSHO) shall bring such hazard to the attention of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, necessary action shall be taken to re-establish and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Disregard for the provisions of this specification or the accepted SSHP shall be cause for stopping of work until the matter has been rectified.

### 1.7.3 Availability

The SSHP shall be made available in accordance with CFR 29 Part 1910, Section .120 (b)(1)(v) and CFR 29 Part 1926, Section .65 (b)(1)(v).

### 1.7.4 Elements

Topics required by CFR 29 Part 1910, Section .120 (b)(4) CFR 29 Part 1926, Section .65 (b)(4) and the Accident Prevention Plan as described in Appendix A of EM 385-1-1 and those described in this section shall be addressed in the SSHP. Where the use of a specific topic is not applicable to the project, the

SSHP shall include a statement to justify its omission or reduced level of detail and establish that adequate consideration was given the topic.

## 1.8 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

### 1.8.1 Project/Site Conditions

The following information is a record of site contaminants and a description of the site. This information is provided to assist in preparing the SSHP.

#### 1.8.1.1 Site Information

1.8.1.1.1 There is potential for encountering petroleum hydrocarbon and/or solvent contaminated soils and groundwater during the excavation activities associated with the construction of the SOF Company Administration Building. This information is derived from investigations that have taken place in and around the site area. The most recent study ( Dec. 1996) and resulting memo(CESAS-EN-GG) states; "The ground water contained low concentrations of metals at levels below the state-defined action level; however, elevated levels of solvents above state defined action levels were detected in each ground-water sample." The solvents identified were cis-1,2 dichloroethene (12 Fg/l), trichloroethene (73 Fg/l) and tetrachloroethene (7.7 Fg/l). Statement was also made that during the initial drilling at the site, drill crew personnel identified a strong hydrocarbon odor in the soil borings. This limited information does not preclude the possibility that other contamination may exist at this site and may not be limited to petroleum hydrocarbons.

#### 1.8.1.2 List of Available Documents

There is one study/investigation available that can provide pertinent information for the soil contamination and concentrations at the proposed construction site. Study/investigation is identified (by SUBJECT) in CESAS-EN-GG Memoranda as: HTRW Investigation at SOF Company Administration Facility at Hunter Army Airfield, Savannah, Georgia, 27 January 1997 and Attachment 1 - Chemical Data and Data Review, USACE, 1997.

### 1.8.2 Plan Requirements

The SSHP shall include a site description and contamination characterization section that addresses the following elements:

a. Description of site location, topography, size and past uses of the site.

b. A list of contaminants which may present occupational health and safety hazards. This list shall be created by evaluating and researching sources of information from typical base operations that use solvents, petroleum hydrocarbon sites as well as past site activities. The contamination characterization shall be reviewed and revised if new chemicals are identified as work progresses.

## 1.9 HAZARD/RISK ANALYSIS

The SSHP shall include a safety and health hazard/risk analysis for each site task and operation to be performed. The hazard/risk analysis shall provide information necessary for determining safety and health procedures, equipment, and training to protect onsite personnel, the environment, and the public. Available site information shall be reviewed when preparing the "Hazard/Risk Analysis" section of the SSHP. The following elements, at a minimum, shall be addressed.

### 1.9.1 Site Tasks and Operations (Workplan)

The SSHP shall include a comprehensive section that addresses the tasks and objectives of the site operations and the logistics and resources required to reach those tasks and objectives if contamination is discovered. Based on the type of remediation required, the following is a list of anticipated major site tasks and operations to be performed: soil excavation, temporary storage and control of soil, hauling, backfill, grading, and possibly seeding, mulching and fertilizing of parts of the site that may not be covered by construction. This is not a complete list of site tasks and operations, therefore, it shall be expanded and/or revised, during preparation of the SSHP as necessary.

1.9.2 Hazards

The following potential hazards may be encountered during site work. These are not complete lists, therefore, they shall be expanded and/or revised as necessary during preparation of the SSHP. These hazards may be addressed in text format or in table format.

1.9.2.1 Safety Hazards

Unsafe operation of heavy equipment and machinery, uneven walking/working surfaces, excavation safety (to include possible confined space hazards created by excavation depth or combination of depth and organic vapors etc.), improperly used hand tools, improper lifting techniques. Possible

1.9.2.2 Chemical Hazards

Potential chemical hazards that may be encountered during site work are discussed in paragraph SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION. The Hazard/Risk Analysis section of the SSHP shall describe the chemical, physical, and toxicological properties of contaminants, sources and pathways of employee exposures, anticipated onsite and off site exposure level potentials, and regulatory (including Federal, state, and local) or recommended protective exposure standards. The SSHP shall also address employee exposure to hazardous substances brought onsite, and shall comply with the requirements of CFR 29 Part 1910, Section .1200 and CFR 29 Part 1926, Section .59, Hazard Communication.

1.9.2.3 Physical Agents
High noise, hand/body vibration hazards from tools and heavy machinery, repetitive motion injury from physical labor, and noise.

1.9.2.4 Radiological Hazards
There is no known radiological hazards at this site.

1.9.2.5 Biological Hazards
Venomous snakes and insects, poisonous plants. Probably not a great concern at this site.

1.9.3 Action Levels

1.9.3.1 General

Action levels shall be established for the situations listed below, at a minimum. The action levels and required actions (engineering controls, changes in PPE, etc.) shall be presented in the SSHP in both text and tabular form. It will be the responsibility of the Contractor to determine the type and concentration of contamination.

a. Explanation and implementation of engineering controls and work practices.

b. Upgrade or downgrade in level of personal protective equipment.

c. Work stoppage and/or emergency evacuation of onsite personnel.

d. Prevention and/or minimization of public exposures to hazards created by site activities.

1.9.3.2 Confined Space Entry

There is no confined space entry for this project. Should a need to enter a confine space arise (as mentioned in section 1.9.2.1 of this specification), a Confined Space Entry Plan shall be developed and submitted as an addendum to this SSHP for government review and acceptance.

1.10 ACTIVITY HAZARD ANALYSIS

Prior to beginning each major phase of work, an Activity Hazard Analysis shall be prepared by the Contractor performing that work and submitted for review and acceptance. The format shall be in accordance with EM 385-1-1, Section 1, figure 1-1. A major phase of work is defined as an operation involving a type of work presenting hazards not experienced in previous operations or where a new subcontractor or work crew is to perform the task. The analysis shall define the activities to be performed and identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the activity hazard analysis has been accepted and a preparatory meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activities, including the government onsite representatives. The activity hazard analyses shall be continuously reviewed and when appropriate, modified to address changing site conditions or operations with the concurrence of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer. Activity hazard analyses shall be attached to and become a part of the SSHP.

1.11 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

A qualified Safety and Health Manager, SSHO, and at least two additional persons certified in first aid and CPR are required.

An organizational structure shall be developed that sets forth lines of authority (chain of command), responsibilities, and communication procedures concerning site safety, health, and emergency response. This organizational structure shall cover management, supervisors and employees of the Contractor and subcontractors. The structure shall include the means for coordinating and controlling work activities of subcontractors and suppliers. The SSHP shall include a description of this organizational structure as well as qualifications and responsibilities of each of the following individuals. The Contractor shall obtain Contracting Officer's acceptance before replacing any member of the Safety and Health Staff. Requests shall include the names, qualifications, duties, and responsibilities of each proposed replacement.

1.11.1 Site Superintendent

A Site Superintendent, who has responsibility to implement the SSHP, the authority to direct work performed under this contract and verify compliance, shall be designated.

1.11.2 Safety and Health Manager

1.11.2.1 Qualifications

The services of an Industrial Hygienist certified by the American Board of Industrial Hygiene(ABIH). The name, qualifications, education summary and documentation, ABIH certificate, and specific work experience summary shall be included in the SSHP. The Safety and Health Manager shall have the following additional qualifications:

a. A minimum of 3 years experience in developing and implementing safety and health programs at hazardous waste sites.

b. Documented experience in supervising professional and technician level personnel.

c. Documented experience in developing worker exposure assessment programs and air monitoring programs and techniques.

d. Documented experience in the development of personal protective equipment programs, including programs for working in and around potentially toxic, flammable and combustible atmospheres and confined spaces.

e. Working knowledge of state and Federal occupational safety and health regulations.

1.11.2.2 Responsibilities

The Safety and Health Manager shall:

a. Be responsible for the development, implementation, oversight, and enforcement of the SSHP.

b. Sign and date the SSHP (drafts, final document, and addendums) prior to submittal.

c. Be present onsite during some portion, other than mobilization, of remedial activities.

d. Visit the site as needed and at least once in the duration of activities, to audit the effectiveness of the SSHP.

e. Be available for emergencies.

f. Provide onsite consultation as needed to ensure the SSHP is fully implemented.

g. Coordinate any modifications to the SSHP with the Site Superintendent, the SSHO, and the Contracting Officer.

h. Provide continued support for upgrading/downgrading of the level of personal protection.

i. Be responsible for evaluating air monitoring data and recommending changes to engineering controls, work practices, and PPE.

j. Review accident reports and results of daily inspections.

k. Serve as a member of the Contractor's quality control staff.

1.11.3 Site Safety and Health Officer (SSHO)

1.11.3.1 Qualifications

An individual and one alternate shall be designated the Site Safety and Health Officer (SSHO). The name, qualifications (education and training summary and documentation), and work experience of the Site Safety and Health Officer and alternate shall be included in the SSHP. The SSHO shall have the following qualifications:

a. A minimum of 2 years experience in implementing safety and health programs at hazardous waste sites where Level C personal protective equipment was required.

b. Documented experience in construction techniques and construction safety procedures.

c. Working knowledge of Federal and state occupational safety and health regulations.

d. Specific training in personal and respiratory protective equipment program implementation, and in the proper use of air monitoring instruments, and air sampling methods.

1.11.3.2 Responsibilities

The Site Safety and Health Officer shall:

a. Assist and represent the Safety and Health Manager in onsite training and the day to day onsite implementation and enforcement of the accepted SSHP.

b. Be assigned to the site on a full time basis for the duration of field activities. The SSHO shall have limited duties outside the Safety and Health related duties. If operations are performed during more than one work shift per day, a site Safety and Health Officer shall be present for each shift.

c. Have authority to ensure site compliance with specified safety and health requirements, Federal, state and OSHA regulations and all aspects of the SSHP including, but not limited to, activity hazard analyses, air monitoring, use of PPE, decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls, the emergency response plan, confined space entry procedures, spill containment program, and preparation of records by performing a daily safety and health inspection and documenting results on the Daily Safety Inspection Log.

d. Have authority to stop work if unacceptable health or safety conditions exist, and take necessary action to re-establish and maintain safe working conditions.

e. Consult with and coordinate any modifications to the SSHP with the Safety and Health Manager, the Site Superintendent, and the Contracting Officer.

f. Serve as a member of the Contractor's quality control staff on matters relating to safety and health.

g. Conduct accident investigations and prepare accident reports.

h. Review results of daily quality control inspections and document safety and health findings into the Daily Safety Inspection Log.

i. In coordination with site management and the Safety and Health Manager, recommend corrective actions for identified deficiencies and oversee the corrective actions.

1.11.4 Persons Certified in First Aid and CPR

At least two persons who are currently certified in first aid and CPR by the American Red Cross or other ARC approved agency shall be onsite at all times during site operations. They shall be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of CFR 29 Part 1910, Section .1030. These persons may perform other duties but shall be immediately available to render first aid when needed.

1.12 TRAINING

Personnel shall receive training in accordance with the Contractor's written safety and health training program and CFR 29 Part 1910 Section .120, CFR 29 Part 1926 Sections .62 and .65, and CFR 29 Part 1926 Section .21. The SSHP shall include a section describing training requirements.

1.12.1 General Hazardous Waste Operations Training

Personnel entering the exclusion or contamination reduction zones shall have successfully completed 40 hours of hazardous waste instruction off the site; 3 days actual field experience under the direct supervision of a trained, experienced supervisor; and 8 hours refresher training annually. Air sampling crews, heavy equipment operators, and other incidental site personnel shall be considered as having the potential need to enter the exclusion zone and shall be 40 hour trained. Personnel such as electricians and workers with non-soil, or groundwater —related tasks may not need to be 40 hour trained. Work should be sequenced so as to keep them out of exclusion areas until hazards are controlled. Onsite supervisors shall have completed the above training and 8 hours of additional, specialized training covering at least the following topics: the employer's safety and health program, personal protective equipment program, spill containment program, and health hazard monitoring procedures and techniques. Copies of current training certification statements or certificates shall be submitted with the SSHP (FIO).

1.12.2 Site—specific Training

Site-specific training sessions shall be documented in the field log and field reports.

1.12.2.1 Initial Session (Pre-entry Briefing)

Should contaminated soil or groundwater be discovered and prior to commencement of onsite field activities to remove such soils or groundwater, all site employees, including those assigned only to the Support Zone, shall attend a site-specific safety and health training session of at least 1 hour duration. This session shall be conducted by the Safety and Health Manager and the Site Safety and Health Officer to ensure that all personnel are familiar with requirements and responsibilities for maintaining a safe and healthful work environment. Procedures and contents of the accepted SSHP and of EM 385-1-1 shall be thoroughly discussed. The Contracting Officer shall be notified at least 5 days prior to the initial site-specific training session so government personnel involved in the project may attend.

1.12.2.2 Periodic Sessions

Periodic onsite training shall be conducted by the SSHO daily for personnel assigned to work at the site during the following day. The training shall

address safety and health procedures, work practices, any changes in the SSHP, activity hazard analyses, work tasks, or schedule; results of previous day's air monitoring, review of safety discrepancies and accidents. Should an operational change affecting onsite fieldwork be made, a meeting prior to implementation of the change shall be convened to explain safety and health procedures. Site-specific training sessions for new personnel, visitors, and suppliers shall be conducted by the SSHO using the training curriculum outlines developed by the Safety and Health Manager.

1.12.3 Other required training.

Verification of CPR and First Aid Training (in accordance with 385-1-1), Respirator training, including fit testing, and all other health and safety training mandated by the section 1.1 References shall be submitted. (FIO)

1.13 PERSONAL PROTECTIVE EQUIPMENT

1.13.1 General

In accordance with CFR 29 Part 1910 Section .120 (g)(5) and CFR 29 Part 1926 Section .65 (g)(5), a written Personal Protective Equipment (PPE) program which addresses the elements listed in that regulation, and which complies with respiratory protection program requirements of CFR 29 Part 1910 Section .134, is to be included in the employer's Safety and Health Program. The Site Safety and Health Plan shall detail the minimum PPE ensembles (including respirators) and specific materials from which the PPE components are constructed for each site-specific task and operation to be performed, based upon the hazard/risk analysis. Components of levels of protection (C, D and modifications) must be relevant to site-specific conditions, including heat and cold stress potential and safety hazards. Only respirators approved by NIOSH shall be used. Onsite personnel shall be provided with appropriate personal protective equipment. Protective equipment and clothing shall be kept clean and well maintained. The PPE section of the SSHP shall include site-specific procedures to determine PPE program effectiveness and for onsite fit-testing of respirators, cleaning, maintenance, inspection, and storage of PPE.

1.13.2 Levels of Protection

The Safety and Health Manager shall establish appropriate levels of protection for each work activity based on review of historical site information, existing data, an evaluation of the potential for exposure (inhalation, dermal, and ingestion) during each task, past air monitoring results, and a continuing safety and health monitoring program. The Safety and Health Manager shall also establish action levels for upgrade or downgrade in levels of PPE from the following specified minimum levels of protection. Protocols and the communication network for changing the level of protection shall be described in the SSHP. The PPE reassessment protocol shall address air monitoring results, potential for exposure, changes in site conditions, work phases, job tasks, weather, temperature extremes, individual medical considerations, etc.

1.13.2.1 Components of Levels of Protection

For guidance in determining appropriate components for levels of protection, utilize the following references:

NIOSH, OSHA, USCG, EPA, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, (latest edition), NIOSH 85-115;
EM 385-1-1 Section 5 and Appendix L; CFR 29 Part 1910.120,

Appendix B; and CFR 29 Part 1926.65, Appendix B.

Components must be included that provide protection for the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing. Specify the types of materials (e.g., neoprene, nitrile, etc.) for gloves and boots and types of cartridges for air purifying respirators based on site-specific contaminants. The following items constitute minimum protective clothing and equipment ensembles to be utilized during this project:

Level D

Coveralls or work clothes, steel toed safety boots, (leather or impervious), work gloves, safety glasses, ear plugs and/or muffs with documented noise reduction rating, and hard-hat. This level shall be utilized where there are no dusts or contact with contaminated soils hazards.

Modified Level D

All of the above, plus additional skin and eye protection such as nitrile gloves, steel toe/shank washable safety boots, splash protection face shields and goggles, Tyvek or breathable coveralls. (Note: Surgical latex gloves are not to be used at anytime on this project.) This level shall be utilized where there are no inhalation or ingestion dust hazards, but soil contact is present.

Level C

All of the Modified Level D requirements plus respiratory protection by air purifying respirators (powered or negative pressure respirators).

Level B

It is not expected that Level B work be performed under the scope of this project.

1.13.2.2 Initial Minimum Levels of PPE by Task

The Contractor’s CIH shall determine the initial minimum protective equipment requirements for each major task and operation. This information shall be based upon review of potential contaminants found at this site. The information shall be reviewed and applied to the list of tasks and operations and these levels of protection shall be expanded and/or revised during preparation of the SSHP.

1.13.3 PPE for Government Personnel

Two clean sets of personal protective equipment and clothing, per week, at Level C protection level (excluding air-purifying negative-pressure respirators and safety shoes, which will be provided by individual visitors), as required for entry into the Exclusion Zone and/or Contamination Reduction Zone, shall be available for use by the Contracting Officer or official visitors. The items shall be cleaned and maintained by the Contractor and stored on site and clearly marked: "FOR USE BY GOVERNMENT ONLY." The Contractor shall provide basic training in the use and limitations of the PPE provided, and institute administrative controls to check prerequisites prior to issuance. Such prerequisites include meeting minimum training requirements for the work tasks to be performed and medical clearance for site hazards and respirator use.

1.14 MEDICAL SURVEILLANCE

The Safety and Health Manager, in conjunction with an Occupational Physician, shall detail, in the employer's Safety and Health Program and the SSHP, the medical surveillance program that includes scheduling of examinations, certification of fitness for duty, compliance with OSHA requirements, and

information provided to the physician. Examinations shall be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place. Medical surveillance protocols and examination and test results shall be reviewed by the Occupational Physician. The medical surveillance program shall contain the requirements specified below. Personnel working in contaminated areas of the site shall have been examined as prescribed in CFR 29 Part 1910 Section .120, and CFR 29 Part 1926 Sections .62 and .65, and determined medically fit to perform their duties.

1.14.1 Frequency of Examinations

Employees shall have been provided with medical examinations as specified, within the past 12 months and shall receive exams annually thereafter (if contract duration exceeds 1 year); on termination of employment; reassignment in accordance with CFR 29 Part 1910 Section .120 (e)(3)(i)(C), and CFR 29 Part 1926 Section .65 (e)(3)(i)(C); if the employee develops signs or symptoms of illness related to workplace exposures; if the physician determines examinations need to be conducted more often than once a year; and when an employee develops a lost time injury or illness during the period of this contract. The supervisor shall be provided with a written statement signed by the physician prior to allowing the employee to return to the work site after injury or illness resulting in a lost workday, as defined in CFR 29 Part 1904 Section .12 (f).

1.14.2 Content of Examinations

The following elements shall be included in the medical surveillance program. Additional elements may be included at the discretion of the occupational physician responsible for reviewing the medical surveillance protocols.

a. Complete medical and occupational history (initial exam only).

b. General physical examination of major organ systems.

c. Pulmonary function testing including FVC and FEV 1.0.

d. CBC with differential.

e. Blood chemistry screening profile (e.g. SMAC 20/25).

f. Urinalysis with microscopic examination.

g. Audiometric testing (as required by Hearing Conservation Program).

h. Visual acuity.

i. Chest X-Ray. (This test should be performed no more frequently than every 4 years, unless directed by Occupational Physician.)

j. Electrocardiogram (as directed by Occupational Physician).

k. Urine heavy metals (arsenic, cadmium, chromium, and mercury).

l. Serum lead.

m. Zinc protoporphyrin.

1.14.3 Information Provided to the Occupational Physician

The physician shall be furnished with the following:

a. Site information from paragraph: 1.8 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION.

b. Information on the employee's anticipated or measured exposure.

c. A description of any PPE used or to be used.

d. A description of the employee's duties as they relate to the employee's exposures (including physical demands on the employee and heat/cold stress).

e. A copy of CFR 29 Part 1910 Section .120, or CFR 29 Part 1926 Section .65.

f. Information from previous examinations not readily available to the examining physician.

g. A copy of Section 5.0 of NIOSH Pub No. 85-115.

h. Information required by CFR 29 Part 1910 Section .134.

1.14.4 Physician's Written Opinion

Before work begins a copy of the physician's written opinion for each employee shall be obtained and furnished to the Safety and Health Manager and the employee. The opinion shall address the employee's ability to perform hazardous remediation work and shall contain the following:

a. The physician's recommended limitations upon the employee's assigned work and/or PPE usage. (FIO)

b. The physician's opinion about increased risk to the employee's health resulting from work.

c. A statement that the employee has been informed and advised about the results of the examination.

1.14.5 Medical Records

Documentation of medical exams shall be provided as part of the SSHP. Medical records shall be maintained in accordance with CFR 29 Part 1910 Section 120, and CFR 29 Part 1926 Section 65.

1.15 Exposure Monitoring/Air Sampling Program

The Safety and Health Manager shall prepare and implement an exposure monitoring/air sampling program to identify and quantify safety and health hazards and airborne levels of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment for affected site personnel. Minimum initial requirements for the program are delineated below. Available site information shall be reviewed and the exposure monitoring/air sampling program shall be expanded and/or revised for submittal as part of the SSHP.

1.16 HEAT AND COLD STRESS MONITORING

The Safety and Health Manager shall develop a heat stress monitoring program for onsite activities. Details of the monitoring program, including schedules for work and rest, and physiological monitoring requirements, shall be

described in the SSHP. Personnel shall be trained to recognize the symptoms of heat. The SSHO and an alternate person shall be designated, in writing, to be responsible for the heat and cold stress monitoring program.

1.16.1 Heat Stress

Physiological monitoring shall commence when the ambient temperature is above 21.1 degrees C (70 degrees F). Monitoring frequency shall increase as the ambient temperature increases or as slow recovery rates are observed. An adequate supply of cool drinking water shall be provided for the workers. NIOSH Pub No. 85-115 may be consulted for guidance in determining protocols for prevention of heat stress.

1.17 SAFETY PROCEDURES, ENGINEERING CONTROLS AND WORK PRACTICES
The SSHP shall describe the standard operating safety procedures, engineering controls and safe work practices to be implemented for the work covered. These shall include, but not be limited to, the following:

1.17.1 General Site Rules/Prohibitions

General site rules/prohibitions (buddy system, eating, drinking, and smoking restrictions, etc.) The SSHP shall document procedures to prevent the spread of contaminants from workers' hands and clothing to break areas, vehicles, or other areas denoted as Aclean.@ These rules may be addressed briefly here and expanded on as required in the sections >Site Control Measures,' 1.20 and >Personal Hygiene and Decontamination,' 1.21.

1.17.2 Work Permit Requirements

Excavation, hot work, confined space, etc.

1.17.3 Material Handling Procedures

Soils, liquids, debris, drums, etc.

1.17.3.1 Spill and Discharge Control

Written spill and discharge containment/control procedures shall be developed and implemented. Procedures need to address liquids brought onsite such as kerosene, gasoline, diesel, lubricating oils, cleaning solvents, etc. These procedures shall describe prevention measures, such as building berms or dikes; spill control measures and material to be used (e.g. booms, vermiculite); location of the spill control material; personal protective equipment required to cleanup spills; disposal of contaminated material; and who is responsible to report the spill. Storage of contaminated material or hazardous materials shall be appropriately bermed, diked and/or contained to prevent any spillage of material on uncontaminated soil. If the spill or discharge is reportable, and/or human health or the environment are threatened, the National Response Center, the state, and the Contracting Officer shall be notified as soon as possible.

1.17.4 Hot Work

Hot work shall not be permitted except as outlined herein. Prior to conducting hot work, a hot work permit shall be prepared and submitted. An example format for a hot work permit shall be included in the SSHP. The permit shall describe compliance with the following procedures. Hot work shall not be performed unless monitoring indicates it is less than 10% of the LFL/LEL until the hot work is completed. The hot work includes heat cutting and sealing of geosynthetic membranes, welding, cutting, grinding, sawing, or other similar operations which could be expected to potentially generate

combustion-producing temperatures or sparks, or which could produce potentially hazardous fumes or vapors. An individual at each hot work site shall be designated as a fire watch. This person's sole responsibility shall be to monitor the hot work and have immediate access to the fire extinguisher located at each hot work site. A new permit shall be obtained at the start of each work shift during which hot work will be conducted.

1.17.5 Ignition Sources

State how ignition sources will be controlled.

1.17.6 Fire Protection and Prevention

This section may be addressed separately in the Accident Prevention Plan portion or under the spill prevention portion of the SSHP.

1.17.7 Electrical Safety

All sources of electrical hazards shall be identified and controlled prior to start of field work. Electrically operated equipment such as ventilation fans, compressors for spray cleaning, sump pumps, etc. must be addressed. Include use of bonding and grounding in this section.

1.17.8 Excavation and Trench Safety

The SSHP needs to include standard safety practices for personnel as well as equipment.

1.17.9 Guarding of Machinery and Equipment

Address any specific hazards peculiar to the equipment which will be brought onsite.

1.17.10 Lockout/Tagout

Address any specific hazards peculiar to the equipment which will be brought onsite.

1.17.11 Hazard Communication

As per the Hazard Communication Standard, all Contractor and Subcontractor employees, shall have received training in the understanding of the hazards associated with their jobs. Material Safety Data Sheets shall be available on location at all times for hazardous materials brought onsite. A list of such materials shall be appended to the SSHP and/or submitted as addendums as phases change.

1.17.12 Illumination

Address any specific needs peculiar to the plan of operations.

1.17.13 Sanitation

Address any specific needs peculiar to the site.

1.17.14 Engineering Controls

Address any specific hazard controls peculiar to the operations which will be performed onsite.

1.17.15 Signs and Labels

Address any specific signs or labels peculiar to the equipment, procedures or areas onsite as well as leaving the site.

1.17.16 Waste Disposal

Address any specific disposal practices and procedures. This shall include control and handling of decontamination waters and used PPE.

1.18 SITE CONTROL MEASURES

In order to prevent the spread of contamination and control the flow of personnel, vehicles, and materials into and out of work areas, site control measures shall be established and described in the SSHP. The SSHP shall describe the methodology to be used by the Safety and Health Manager and SSHO in determining work zone designations and their modifications, and procedures to limit the spread of contamination. The SSHP shall include procedures for the implementation and enforcement of safety and health rules for all persons on the site, including employers, employees, outside Contractors, government representatives, and visitors.

1.18.1 Work Zones

Initial anticipated work zone boundaries shall be shown on the drawings (GA). Utilizing this guidance, work zone boundaries (exclusion zone, including restricted and regulated areas; contamination reduction zone; and support zone) and access points shall be established and the boundary delineations shall be included on the drawings and in the SSHP. Delineation of work zone boundaries shall be based on the contamination characterization data and the hazard/risk analysis to be performed as described in paragraph: HAZARD/RISK ANALYSIS. As work progresses and field conditions are monitored, work zone boundaries may be modified with approval of the Contracting Officer. Work zones shall be clearly identified and marked in the field (using fences, tape, signs, etc.). A site map, showing work zone boundaries and locations of decontamination facilities, shall be posted in the onsite office. Work zones shall consist of the following:

a. Exclusion Zone (EZ): The exclusion zone is the area where hazardous contamination is either known or expected to occur and the greatest potential for exposure exists. Entry into this area shall be controlled and exit may only be made through the CRZ.

b. Contamination Reduction Zone (CRZ): The CRZ is the transition area between the Exclusion Zone and the Support Zone. The personnel and equipment decontamination areas shall be separate and unique areas located in the CRZ.

c. Support Zone (SZ): The Support Zone is defined as areas of the site, other than exclusion zones and contamination reduction zones, where workers do not have the potential to be exposed to hazardous substances or dangerous conditions resulting from hazardous waste operations. The Support Zone shall be secured against active or passive contamination. Site offices, parking areas, and other support facilities shall be located in the Support Zone.

1.18.2 Site Control Log

A log of personnel visiting, entering, or working on the site shall be maintained (FIO). The log shall include the following: date, name, agency or company, time entering and exiting site, time entering and exiting the exclusion zone (if applicable), and personal protective equipment utilized. Before visitors are allowed to enter the Contamination Reduction Zone or Exclusion Zone, they shall show proof of current training, medical surveillance and respirator fit testing (if respirators are required for the

tasks to be performed) and shall fill out the Certificate of Worker or Visitor Acknowledgment. This visitor information, including date, shall be recorded in the log.

1.18.3 Communication

An employee alarm system that has adequate means of on and off site communication shall be provided and installed in accordance with CFR 29 Part 1910 Section .165. The means of communication shall be able to be perceived above ambient noise or light levels by employees in the affected portions of the workplace. The signals shall be distinctive and recognizable as messages to evacuate or to perform critical operations.

1.18.4 Site Signs

Signs shall be printed in bold large letters on contrasting backgrounds in English or where appropriate in the predominant language of workers unable to read English. Signs shall be visible from all points where entry might occur and at such distances from the restricted area that employees may read the signs and take necessary protective steps before entering.

1.19 PERSONAL HYGIENE AND DECONTAMINATION

Personnel entering the Exclusion or Contamination Reduction Zones or otherwise exposed or subject to exposure to hazardous chemical vapors, liquids, or contaminated solids shall adhere to the following personal hygiene and decontamination provisions. Decontamination shall be performed in the CRZ prior to entering the Support Zone from the Exclusion Zone. Chapter 10.0 of NIOSH Pub No. 85-115 shall be consulted when preparing decontamination procedures. A detailed discussion of personal hygiene and decontamination facilities and procedures to be followed by site workers shall be submitted as part of the SSHP. Employees shall be trained in the procedures and the procedures shall be enforced throughout site operations. Persons disregarding these provisions of the SSHP shall be barred from the site. Dry decontamination shall be done only for those workers involved in perimeter work.

1.19.1 Decontamination Facilities

The following facilities shall be provided:

A personnel decontamination facility in the CRZ is required. This facility shall be used by both Contractor personnel and government representatives. The decontamination facility shall provide a secure barrier between the clean decon site and the contaminants, and at no time shall any wash/rinse fluids be allowed to encounter site soil. There shall be set-up a series of wash/rinse basins for coveralls and boots, a separate area for contaminated respirator holding, and contaminated survey/hand equipment holding until they have been certified clean, soap, water and towels for washing hands and face, secure labeled trash receptacles for disposables, and secure, labeled bags or barrels for material to be deconned at a later time (i.e. end of the day). A written decon line procedure with supplies shall be included in the SSHP. Materials shall include a series of wash/rinse containers such as kiddie pools, wash tubs, or other sturdy plastic containers which allows the worker to stand comfortably while undergoing decon. The connecting walking areas shall be covered with plastic or visqueen to control decon water dispersion and mud generation. Disposable or decon-able chairs shall be provided to assist in PPE donning and removal. Other supplies or features such as shade canopies, respirator disinfecting station, monitoring equipment decon, etc., shall be set up as needed. It should be kept in mind that the hazards of this site are possibly contaminated soils and contaminated liquid, volatile, or acutely

toxic materials(suspected or confirmed human carcinogens). With appropriate documentation of exposures, PPE downgrades may include double- breathable suits that can be HEPA vacuumed before removal. The decon station designer should keep this in mind.

1.19.2 Procedures

A written decon line procedure with all necessary supplies shall be developed and included in the SSHP. Any contact with contaminated soil or groundwater or waste material shall require that person to go through decontamination procedures. The decon alley shall be the only exit point from the exclusion zone, even when only Level D is in effect.

1.20 EQUIPMENT DECONTAMINATION

Vehicles and equipment used in the EZ shall be decontaminated in the CRZ prior to leaving the site. The procedures for decontamination of vehicles and equipment shall be addressed in the SSHP.

1.20.1 Decontamination Facilities

A vehicle/equipment decontamination station shall be provided within the CRZ for decontaminating vehicles and equipment leaving the EZ. The location shall be included in the zoning map submitted in the SSHP. The design and construction of the decontamination pad shall be included in the SSHP. The decontamination station shall include the following: A continuous, impervious surface, supported by rigid berms or walls designed to capture decontamination water, including overspray, and shall allow for collection and removal of the decontamination water using sumps, dikes and ditches as required. The entrance to the pad shall have a lip or berm a minimum of 4@ high to contain heavy rains or decon waters. The decon pad shall be washed down at the end of the shift and waters and soil safely collected and secured for the night. Materials used in construction of the decon pad shall be double wrapped or protected from exposure to contaminated liquids so that the materials themselves (other than the plastic) do not become contaminated wastes.

1.20.2 Procedures

Procedures for equipment decontamination shall be developed and utilized to prevent the spread of contamination into the SZ and off site areas. These procedures shall address disposal of contaminated products and spent materials used on the site, including containers, fluids, oils, etc. Any item taken into the EZ shall be assumed to be contaminated and shall be inspected and/or decontaminated before the item leaves the area. Vehicles, equipment, and materials shall be cleaned and decontaminated prior to leaving the site. Construction material shall be handled in such a way as to minimize the potential for contaminants being spread and/or carried off site. Prior to exiting the site, vehicles and equipment shall be monitored to ensure the adequacy of decontamination.

1.21 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

The SSHP shall describe the emergency and first aid equipment to be available onsite. The following items, as a minimum, shall be maintained onsite and available for immediate use:

a. First aid equipment and supplies approved by the consulting physician.

b. Emergency eyewashes which comply with ANSI Z358.1. They are to be staged at the area of greatest potential need and not in vehicles or other restricted access areas.

c. Fire extinguishers with a minimum rating of 20-A shall be provided at site facilities and in all vehicles and at any other site locations where flammable or combustible materials present a fire risk.

## 1.22 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

An Emergency Response Plan, that meets the requirements of CFR 29 Part 1910 Section .120 (l) and CFR 29 Part 1926 Section .65 (l), shall be developed and implemented as a section of the SSHP. In the event of any emergency, the Contractor shall, without delay, alert all onsite employees that there is an emergency situation; take action to remove or otherwise minimize the cause of the emergency; alert the Contracting Officer; and institute measures necessary to prevent repetition of the conditions or actions leading to, or resulting in, the emergency. Employees that are required to respond to hazardous emergency situations shall be trained in how to respond to such expected emergencies. The plan shall be rehearsed regularly as part of the overall training program for site operations. The plan shall be reviewed periodically and revised as necessary to reflect new or changing site conditions or information. The following elements, as a minimum, shall be addressed in the plan:

a. Personnel roles, lines of authority, communications for emergencies.

b. Emergency recognition and prevention.

c. Site topography, layout, and prevailing weather conditions.

d. Criteria and procedures for site evacuation (emergency alerting procedures, employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control).

e. Specific procedures for decontamination and medical treatment of injured personnel.

f. Route maps to nearest pre-notified medical facility. Site-support vehicles shall be equipped with maps. At the beginning of project operations, drivers of the support vehicles shall become familiar with the emergency route and the travel time required.

g. Emergency alerting and response procedures including posted instructions and a list of names and telephone numbers of emergency contacts (physician, nearby medical facility, fire and police departments, ambulance service, Federal, state, and local environmental agencies; as well as Safety and Health Manager, the Site Superintendent, the Contracting Officer and/or their alternates).

h. Criteria for initiating community alert program, contacts, and responsibilities.

i. Procedures for reporting incidents to appropriate government agencies. In the event that an incident such as an explosion or fire, or a spill or release of toxic materials occurs during the course of the project, the appropriate government agencies shall be immediately notified. In addition, the Contracting Officer shall be verbally notified immediately and receive a written notification within 24 hours. The report shall include the following items:

(1) Name, organization, telephone number, and location of the Contractor.

(2) Name and title of the person(s) reporting.

(3) Date and time of the incident.

(4) Location of the incident, i.e., site location, facility name.

(5) Brief summary of the incident giving pertinent details including type of operation ongoing at the time of the incident.

(6) Cause of the incident, if known.

(7) Casualties (fatalities, disabling injuries).

(8) Details of any existing chemical hazard or contamination.

(9) Estimated property damage, if applicable.

(10) Nature of damage, effect on contract schedule.

(11) Action taken to ensure safety and security.

(12) Other damage or injuries sustained, public or private.

k. Procedures for critique of emergency responses and follow-up.

1.23 CERTIFICATE OF VISITOR ACKNOWLEDGMENT

A copy of a Contractor-generated certificate of visitor acknowledgment shall be completed and submitted for each visitor allowed to enter contamination reduction or exclusion zones, and for each employee, following the example certificate at the end of this section.

1.24 INSPECTIONS

The SSHO shall perform daily inspections of the job site and the work in progress to ensure compliance with EM 385-1-1, the Safety and Health Program, the SSHP and other occupational health and safety requirements of the contract, and to determine the effectiveness of the SSHP. Procedures for correcting deficiencies (including actions, timetable and responsibilities) shall be described in the SSHP. Follow-up inspections to ensure correction of deficiencies shall be conducted and documented. Daily safety inspection logs shall be used to document the inspections, noting safety and health deficiencies, deficiencies in the effectiveness of the SSHP, and corrective actions taken. The SSHO's Daily Inspection Logs shall be attached to and submitted with the Daily Quality Control reports. Each entry shall include the following: date, work area checked, employees present in work area, PPE and work equipment being used in each area, special safety and health issues and notes, and signature of preparer. In the event of an accident, the Contracting Officer shall be notified according to EM 385-1-1. Within 1 day of any reportable accident, an Accident Report shall be completed on ENG Form 3394 and submitted. (FIO)

1.25 SAFETY AND HEALTH PHASE-OUT REPORT

A Safety and Health Phase-Out Report shall be submitted within 10 working days following completion of the work, prior to final acceptance of the work. The following minimum information shall be included:

a. Summary of the overall performance of safety and health (accidents or incidents including near misses, unusual events, lessons learned, etc.).

b. Final decontamination documentation including procedures and techniques used to decontaminate equipment, vehicles, and onsite facilities.

c. Summary of exposure monitoring and air sampling accomplished during the project.

d. Signatures of Safety and Health Manager and SSHO.

e. All certificates required by this section, that have not been previously submitted. (FIO)

EXAMPLE CERTIFICATE VISITOR ACKNOWLEDGMENT

PROJECT NAME CONTRACT NO.
PROJECT ADDRESS
CONTRACTOR'S NAME
[VISITOR'S NAME

The contract for the above project requires the following: that you be provided with and complete formal and site-specific training; that you be supplied with proper personal protective equipment including respirators; that you be trained in its use; and that you receive a medical examination to evaluate your physical capacity to perform your assigned work tasks, under the environmental conditions expected, while wearing the required personal protective equipment. These things are to be done at no cost to you. By signing this certification, you are acknowledging that you have met these obligations.

I HAVE READ, UNDERSTAND AND AGREE TO FOLLOW THE SITE SAFETY AND HEALTH PLAN FOR THIS SITE.

Name Date

------------------------------ ------------------------------

FORMAL TRAINING: I have completed the following formal training courses that meet OSHA's requirements:

Date Completed

SITE-SPECIFIC TRAINING: I have been provided and have completed the site-specific training required by this Contract. The Site Safety and Health Officer conducted the training. _____

RESPIRATORY PROTECTION: I have been trained in accordance with the criteria in [the Contractor's] [my employer's] Respiratory Protection program. I have been trained in the proper work procedures and use and limitations of the respirator(s) I will wear. I have been trained in and will abide by the facial hair policy. _____

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

MEDICAL EXAMINATION: I have had a medical examination within the last 12 months which was paid for by my employer. The examination included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray. A physician made determination regarding my physical capacity to perform work tasks on the project while wearing protective equipment including a respirator. I was personally provided a copy and informed of the results of that examination. My employer's industrial hygienist evaluated the medical certification provided by the physician and checked the appropriate blank below. The physician determined that there:

were no limitations to performing the required work tasks;

were identified physical limitations to performing the required work tasks.

Date medical exam completed

Visitor's Signature _____
Date _____

Printed Name _____

Social Security Number _____

Contractor's Site Safety and Health Officer Signature _____

Date _____

Printed Name _____

Social Security Number _____

-- End of Section --

Includes Text Adjustment change 1 (coding) (March 1995)

# SECTION 01300

# SUBMITTAL PROCEDURES

## PART 1 GENERAL

### 1.1 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

#### 1.1.1 Government Approved (GA/D or GA/F Level)

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the contract clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings." GA/D indicates review by the designer. GA/F indicates review by the field office.

#### 1.1.2 Information Only

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

### 1.2 APPROVED SUBMITTALS

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

### 1.3 DISAPPROVED SUBMITTALS

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

### 1.4 WITHHOLDING OF PAYMENT

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

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

## 3.1 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Submittals shall be made in the respective number of copies and to the Resident/Area Engineer. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) representative and each item shall be stamped, signed, and dated by the CQC representative indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

## 3.2 SUBMITTAL REGISTER (ENG FORM 4288)

At the end of this section is one set of ENG Form 4288 listing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. Columns "d" through "q" have been completed by the Government; the Contractor shall complete columns "a" and "r" through "t" and submit the forms to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The approved submittal register will become the scheduling document and will be used to control submittals throughout the life of the contract. The submittal register and the progress schedules shall be coordinated.

## 3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. All submittals for all interior finishes (wall, floor, ceiling), wall base, casework, toilet partitions, window treatments and all other similar means requiring coordinated color selection shall be submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 30 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals. An additional 10 calendar days shall be allowed and shown on the register for review and approval of submittals for food service equipment and refrigeration and HVAC control systems.

## 3.4 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) included in Attachment 1 of Section 00800 shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure

proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

## 3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

### 3.5.1 Procedures

The Contractor shall be responsible for the scheduling and control of all submittals. The Contractor is responsible for confirming that the submittal register includes all submittals required by the contract documents.

In addition to those items listed on ENG Form 4288, the Contractor will furnish submittals for any deviation from the plans or specifications. The scheduled need dates must be recorded on the document for each item for control purposes and critical items must be tied to the contractor's approved schedule where applicable.

The Contractor will submit to the Contracting Officer for approval a minimum of five copies of all GA/D or GA/F level submittals. Three copies of all FIO level submittals will be provided. The number of copies of submittals specified in this portion of the contract shall be complied with in lieu of four copies as specifed by FAR 52.236-21.

For those contracts requiring Network Analysis System (NAS), the Contractor will schedule on the NAS critical items of equipment submittals and procurement activities which will, or have the potential to, significantly impact project completion. The inclusion or exclusion of critical items shall be subject to the approval of the Contracting Officer.

Where ENG Form 4025 must be submitted prior to approval of the Construction Progress Schedule, the Contractor shall submit an initial annotated ENG Form 4288 upon which dates for submittal, approval and delivery of procurement items shall be included for the first 60 days of the work. Upon approval of the Construction Progress Schedule, or no later than 60 days after Notice to Proceed, the Contractor shall submit final annotated copies of ENG Form 4288. Dates shall be coordinated with the approved Construction Progress Schedule to logically interface with the sequence of construction. Critical item numbers will be shown on the listing if NAS is required.

Furnishing the schedule shall not be interpreted as relieving the Contractor of his obligation to comply with all the specification requirements for the items on the schedule. Contractor's Quality Control representative shall review the listing at least every 30 days and take appropriate action to maintain an effective system. The Contractor shall furnish a list each 30 days of all submittals on which either Government's or Contractor's action is past due. He shall also furnish revised due dates in those cases when the original submittal schedule is no longer realistic. This monthly list of delayed items shall also be annotated by the Contractor to show what corrective action he is taking with regard to slippages in submittal schedule which are attributable to actions by him, his subcontractors, or suppliers.

The Contractor shall provide a complete updated submittal register indicating the current status of all submittals when requested by the Contracting Officer in order to assure himself the schedule is being maintained.

The Contractor shall certify that each submittal is correct and in strict conformance with the contract drawings and specifications. All submittals not subject to the approval of the Contracting Officer will be submitted for information purposes only.

No Corps of Engineers action will be required prior to incorporating these items into the work, but the submittal shall be furnished to the Area/Resident Engineer not less than 2 weeks prior to procurement of Contractor certified material, equipment, etc.

These Contractor approved submittals will be used to verify that material received and used in the job is the same as that described and approved and will be used as record copies. All samples of materials submitted as required by these specifications shall be properly identified and labeled for ready identification, and upon being certified by the Contractor and reviewed by the Contracting Officer, shall be stored at the site of the work for job site use until all work has been completed and accepted by the Contracting Officer. Delegation of this approval authority to Contractor Quality Control does not relieve the Contractor from the obligation to conform to any contract requirement and will not prevent the Contracting Officer from requiring removal and replacement of construction not in contract conformance; nor does it relieve the Contractor from the requirement to furnish "samples" for testing by the Government Laboratory or check testing by the Government in those instances where the technical specifications so prescribe.

Contractor certified drawings will be subject to quality assurance review by the Government at any time during the duration of the contract. No adjustment for time or money will be allowed for corrections required as a result of noncompliance with plans and specifications.

Submittals Requiring Government Approval (GA/D Level or GA/F Level). Where the review authority is designated to the Government, the Contractor is required to sign the certification on ENG Form 4025 in the box beside the remarks block in Section I. The Government will code the items in block h and sign the approval action block in Section II as the approving authority.

Operating and Maintenance Instructions. Six complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment shall be furnished. Each set shall be permanently bound and shall have a hard cover. One complete set shall be furnished at the time test procedures are submitted. Remaining sets shall be furnished before the contract is completed. The following identification shall be inscribed on the covers: The words "OPERATING AND MAINTENANCE INSTRUCTIONS," name and location of the facility, name of the Contractor, and contract number. Fly sheets shall be placed before instructions covering each subject. Instruction sheets shall be approximately 8-1/2 by 11 inches, with large sheets of drawings folded in. Instructions shall include but are not limited to:

(1) System layout showing piping, valves and controls;

(2) Approved wiring and control diagrams;

(3) A control sequence describing startup, operation and shutdown;

(4) Operating and maintenance instructions for each piece of equipment, including lubrication instructions and troubleshooting guide; and

(5) Manufacturer's bulletins, cuts and descriptive data; parts lists and recommended parts.

3.5.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such

deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

## 3.6 CONTROL OF SUBMITTALS

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

## 3.7 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Four copies of the submittal will be retained by the Contracting Officer and one copy of the submittal will be returned to the Contractor.

## 3.8 INFORMATION ONLY SUBMITTALS

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

## 3.9 STAMPS

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

CONTRACTOR

(Firm Name)

_____ Approved

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

SIGNATURE: _____

TITLE: _____

DATE: _____

-- End of Section --

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TITLE AND LOCATION** | | | | **Company Admin Facility** | | | | | | | | | | | **CONTRACTOR** | | | | | | Specification Section | | | | | |
| | | | | **Hunter AAF, GA** | TYPE OF SUBMITTAL | | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 02012-4 | Environmental Protection Plan | | | | | | | | | X | | | D | | | | | | | | | | |
| | | | 02012-7.4 | List of Fish and Wildlife Species | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 02050-1.3 | Work Plan | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 02059-5. | Quality Control Records | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 02110-1.2 | Materials Other Than Salable Timber | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 02110.1.4 | Tree and Stump Removal | | | | X | | | | | | | X | | | | | | | | | | | |
| | | | 02210-1.4 | Field Testing Control | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 02210-1.4 | Field Testing Control | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02210-1.4 | Satisfactory Materials | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02221-1.3 | Testing Facilities | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 02221-1.3 | Test Reports | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02221-1.3 | Inspection, Equipment and Corrective | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02221-1.3 | Certificates of Compliance | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02222A-1.5 | Field Density Tests | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 02222A-1.5 | Testing of Backfill Materials | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 02233-1.4 | Sampling and Testing | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02233-1.4 | Waybills and Delivery Tickets | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 02285-1.3 | Qualifications of Pesticide Applica. | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 02285-1.3 | Manufacturer's Label and Material | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 02285-1.3 | Samples of Pesticides Used in Work | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 02511-1.4 | Field Quality Control | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02511-1.4 | Concrete | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 02550-3.1 | Pavement Job Mix Formula and Test | | | | | | X | | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 02550-3.1 | Pavement Job Mix Formula and Test | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 02550-3.2 | Pavement Job Mix Formula and Test | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02550-3.2 | Pavement Job Mix Formula and Test | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 02550-4.1.1 | Sampling Bituminous Pavement | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 02550-7 | Pavement Samples and Plant Mixtures | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 02550-8.1 | Testing Pavement Samples | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02550-8.2 | Field Control Testing | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02550-9 | Records & Test Data (Quality Control | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02550-9 | Records & Test Data (Quality Control | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 02580-1.3 | Equipment Lists | X | | | | | | | | | | | D | | | | | | | | | | |
| | | | 02580-1.3 | Mixing, Thinning and Application | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 02580-1.3 | Material Tests | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02580-1.3 | Volatile Organic Compound (VOC) | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02698-1.3 | Distribution System | X | | | | | | | | | | | D | | | | | | | | | | |
| | | | 02698-1.3 | Distribution System | | X | | | | | | | | | | D | | | | | | | | | | |
| | | | 02698-1.3 | Distribution System | | | | | | | X | | | | | D | | | | | | | | | | |
| | | | 02698-1. | Welding Procedures and Operators | | | | | | | X | | | | | D | | | | | | | | | | |
| | | | 02720-1.3 | Placing Pipe | | | X | | | | | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 02720-1.3 | Resin Certification | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02720-1.3 | Pipeline Testing | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02720-1.3 | Hydrostatic Test on Watertight Joints | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02720-1.3 | Determination of Density | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02720-1.3 | Frame and Cover for Gratings | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02720-1.3 | Pipe for Culverts and Storm Drains | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 02730-1.4 | Portland Cement | | X | | | X | | | | | | | | | | | | | | | | | |
| | | | 02730-1.4 | (Oil) Resistant Material | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02811-1.3 | Framed Instructions | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 02811-1.3 | Field Training Data | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 02811-1.3 | Design Analysis and Calculations | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 02811-1.3 | Spare Parts | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 02811-1.3 | Sprinkler System | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 02811-1.3 | Sprinkler System | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 02811-1.3 | Field Tests | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02811-1.3 | Sprinkler System | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02811-1.3 | Sprinkler System (O & M Manuals) | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 02831-1.2 | Electro-Mechanical Locks and Gate | | | X | | | | | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 02935-1.2 | Manufacturer's Literature | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 02935-1.2 | Equipment Lists | | | | X | | | | | | | X | | | | | | | | | | | |
| | | | 02935-1.2 | Delivery | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 02935-1.2 | Application of Pesticide | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 02935-1.2 | Maintenance Report | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 02935-1.2 | Turf Establishment Period | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 02935-1.2 | Sod | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02935-1.2 | Fertilizer | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02935-1.2 | Agricultural Limestone | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02935-1.2 | Pesticide Material | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02950-1.2 | Application of Pesticide Material | | | | X | | | | | | | X | | | | | | | | | | | |
| | | | 02950-1.2 | Delivery | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 02950-1.2 | Application of Pesticide Material | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 02950-1.2 | Soil Test | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02950-1.2 | Percolation Test | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 02950-1.2 | Topsoil | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02950-1.2 | Soil Amendents | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02950-1.2 | Plants | | | | | | | X | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | | CONTRACTOR | | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 02950-1.2 | Pesticide | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 02950-1.2 | Plant Establishment Period | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 02950-1.2 | Maintenance Report | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 02950-1.2 | Maintenance Instructions | | | | | | | | | X | | X | | | | | | | | | | | |
| | | | 03100-1.2 | Concrete Formwork | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 03100-1.2 | Form Releasing Agents | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 03300-1.4 | Mixing Proportions | | | | | X | | | | | | | D | | | | | | | | | | |
| | | | 03300-1.4 | Testing and Iinspection for | | | | | X | | | | | | | D | | | | | | | | | | |
| | | | 03300-1.4 | Qualifications | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Clay or Shale Brick | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Concrete Brick | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Concrete Masonry Units (CMU) | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Insulation | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Precast Architectural Concrete | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Masonry Work | | X | | | | | | | | | | D | | | | | | | | | | |
| | | | 04200-1.2 | Cold Weather Installation | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Efflorescence Test | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Field Testing of Mortar | | | | | | X | | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 04200-1.2 | Field Testing of Grout | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Prism Tests | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Fire rated CMU | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Special Inspection | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Concrete Masonry Units (CMU) | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Clay or Shale Brick | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Concrete Brick | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Concrete Masonry Units (CMU) | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Control Joint Keys | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Anchor. Ties, and Bar Positioners | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Expansion Joint Materials | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Joint Reinforcement | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Reinforcing Steel Bars and Rods | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Mortar Coloring | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Insulation | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Precast Concrete Items | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Mortar Admixtures | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Grout Admixtures | | | | | | | X | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 04200-1.2 | Concrete Masonry Units (CMU) | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Concrete Brick | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Clay or Shale Brick | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Precast Concrete Unit | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Anchor, Ties, and Bar Positioners | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Expansion Joint Materials | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Joint Reinforcement | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Insulation | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 04200-1.2 | Portable Panel | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 05120-1.3 | Structural Steel System | | X | | | | | | | | | | D | | | | | | | | | | |
| | | | 05120-1.3 | Structural Connections | | | | | X | | | | | | | D | | | | | | | | | | |
| | | | 05120-1.3 | Erection | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 05120-1.3 | Welder Qualifications | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | 05120-1.3 | Fabrication | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 05210-1.2 | Steel Joists | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 05210-1.2 | Steel Joists | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 05300-1.2 | Deck Units | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 05300-1.2 | Deck Units | | X | | | | | | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 05300-1.2 | Accessories | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 05300-1.2 | Attachments | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 05300-1.2 | Holes and Openings | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 05300-1.2 | Deck Units | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 05450-1.4 | Product Data | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 05450-1.4 | Certification of Compliance | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 05450-1.4 | Shop Drawings | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 05450-1.4 | Design Analysis | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 05500-1.2 | Miscellaneous Metal Items | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 05500-1.2 | Miscellaneous Metal Items | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 06100-1.2 | Structural Wood Members | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 06100-1.2 | Product Installations | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 06100-1.2 | Structural Wood Members | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 06100-1.2 | Installation of Framing | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 06100-1.2 | Grading and Marking | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 06100-1.2 | Insulation | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 06200-1.2 | Finish Carpentry | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 06200-1.2 | Siding | | | | | | | | X | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 06200-1.2 | Moldings | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 06200-1.2 | Fascias and Trim | x | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07160-1.2 | Materials Masonry Dampproofing | | | | | | | X | | | | X | | | | | | | | | | |
| | | | 07220-1.2 | Application of Insulation | | | X | | | | | | | | X | | | | | | | | | | |
| | | | 07220-1.2 | Inspection | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 07220-1.2 | Insulation;isocyunuriate roof insulation | | | | | | | X | | | | X | | | | | | | | | | |
| | | | 07270-1.2 | Firestopping Materials | | X | | | | | | | | | X | | | | | | | | | | |
| | | | 07270-1.2 | Firestopping Materials | | | | | | | X | | | | X | | | | | | | | | | |
| | | | 07270-1.2 | Installer Qualifications | | | | | | | X | | | | X | | | | | | | | | | |
| | | | 07270-1.2 | Inspection | | | | | | | X | | | | X | | | | | | | | | | |
| | | | 07413-1.3 | Metal Roofing and Siding | | X | | | | | | | | | X | | | | | | | | | | |
| | | | 07413-1.3 | Roof Panels | | | | | | | X | | | | X | | | | | | | | | | |
| | | | 07413-1.3 | Installation | | | | | | | X | | | | X | | | | | | | | | | |
| | | | 07413-1.3 | Accessories | | | | | | | X | | | | X | | | | | | | | | | |
| | | | 07413-1.3 | Insulation | | | | | | | X | | | | X | | | | | | | | | | |
| | | | 07413-1.3 | Accessories | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07413-1.3 | Roof Panels | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07413-1.3 | Fasteners | | | | | | | | X | | | X | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 07413-1.3 | Insulation | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07413-1.3 | Gaskets and Insulating Compounds | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07413-1.3 | Sealants | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Design Analysis | X | | | | | | | | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Standing Seam Metal Roof System | | X | | | | | | | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Qualifications | | | | | X | | | | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Tests | | | | | | X | | | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Standing Seam Metal Roof System | | | | | | | X | | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Accessories | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Roof Panels | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Fasteners | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Insulation | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Gaskets and Insulating Compounds | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Sealant | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Concealed Anchor Clip | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07416-1.5 | Subpurlins | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 07416-1.5 | EPDM Rubber Boots | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 08110-1.2 | Thermal Insulated Doors | | | | | | | X | | | | X | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 08110-1.2 | Security Doors | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 08110-1.2 | Sound Rated Doors | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 08120-1.4 | Aluminum Doors and Frames | X | | | | | | | | | | x | | | | | | | | | | | |
| | | | 08120-1.4 | Aluminum Doors and Frames | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 08120-1.4 | Installation | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 08120-1.4 | Cleaning | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 08120-1.4 | Full-Glazed and Flush Doors | | | | | | X | | | | | x | | | | | | | | | | | |
| | | | 08120-1.4 | Finishes | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 08201-1.3 | Wood Doors and Frames | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 08201-1.3 | Fire Doors | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 08201-1.3 | Fire Rated Doors | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 08201-1.3 | High Pressure Laminate Doors | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 08201-1.3 | Factory Coated Natural Finish | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 08201-1.3 | Factory Coated Natural Finish | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 08318-1.3 | Security Vault Door | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 08318-1.3 | Security Vault Door | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 08330-1.3 | Overhead Rolling Door Unit | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 08330-1.3 | Overhead Rolling Door Unit | | X | | | | | | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 08330-1.3 | Overhead Rolling Door Unit | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 08520-1.3 | Aluminum Windows | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 08520-1.3 | Aluminum Windows | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 08520-1.3 | Aluminum Windows | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 08520-1.3 | Aluminum Windows | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 08520-1.3 | Aluminum Windows | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 08520-1.3 | Aluminum Windows | | | | | | | | | | | X | | | | | | | | | | | |
| | | | 08700-1.2 | Hardware and Accessories | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 08700-1.2 | Hardware Schedule | | | | X | | | | | | | X | | | | | | | | | | | |
| | | | 08700-1.2 | Keying Schedule | | | | X | | | | | | | | F | | | | | | | | | | |
| | | | 08700-1.2 | Hardware Accessories | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 08810-1.2 | Glass | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 08810-1.2 | Glazing Accessories | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 08810-1.2 | Glazing Materials and Accessories | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 08810-1.2 | Glass | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 08810-1.2 | Glass | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 09250-1.3 | Steel Framing | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 09250-1.3 | Control Joints | | X | | | | | | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 09250-1.3 | Fire Resistant Assemblies | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 09250-1.3 | Gypsum Wallboard | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 09250-1.3 | Water-Resistant Gypsum Board | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 09250-1.3 | Exterior Gypsum Soffit Board | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 09250-1.3 | Steel Framing | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 09310-1.3 | Tile | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 09310-1.3 | Setting-Bed | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 09310-1.3 | Mortar, Grout, and Adhesive | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 09310-1.3 | Tile | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 09310-1.3 | Mortar and Grout | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 09310-1.3 | Tile | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 09310-1.3 | Mortar, Grout, and Adhesive | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 09310-1.3 | Tile | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 09310-1.3 | Accessories | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 09310-1.3 | Marble Thresholds | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 09510-1.3 | Acoustical Ceiling System | X | | | | | | | | | | x | | | | | | | | | | | |
| | | | 09510-1.3 | Acoustical Ceiling System | | X | | | | | | | | | x | | | | | | | | | | | |
| | | | 09510-1.3 | Fire Resistant Ceilings | | | | | | | X | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 09510-1.3 | Ceiling Attenuation Class and Test | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 09510-1.3 | Acoustical Units | | | | | | | | X | | | | | | | | | | | | | | |
| | | | 09650-1.2 | Resilient Flooring and Accessories | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 09650-1.2 | Resilient Flooring and Accessories | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 09650-1.2 | Resilient Flooring and Accessories | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 09680-1.2 | Carpet and Accessories | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 09680-1.2 | Installation | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 09680-1.2 | Carpet and Accessories | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 09680-1.2 | Moisture Tests | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 09680-1.2 | Carpet and Accessories | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 09680-1.2 | Carpet and Accessories | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 09680-1.2 | Carpet and Accessories - O&M Manuals | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | 09900-1.2 | Paint | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 09900-1.2 | Mixing and Thinning | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 09900-1.2 | Application | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 09900-1.2 | Paint | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | 09900-1.2 | Lead | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 09900-1.2 | Mildewcide and Inssecticide | | | | | | | X | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 09900-1.2 | Volatile Organic Compound (VOC) Content | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 09900-1.2 | Moisture-Curing Polyurethane | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 09900-1.2 | Paint | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 09915-1.3 | Color Board | | | | | | | | X | | | | F | | | | | | | | | | |
| | | | 09950-1.2 | Wall Covering and Accessories | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 09950-1.2 | Installation | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 09950-1.2 | Maintenance | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 09950-1.3 | Wall Covering and Accessories | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 10160-1.3 | Toilet Partition System | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 10160-1.3 | Toilet Partition System | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 10160-1.3 | Toilet Partition System | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 10260-1.2 | Corner Guards | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 10260-1.2 | Wall Guards (Bumper Guards) | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 10260-1.2 | Door Protectors | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 10260-1.2 | Corner Guards | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 10260-1.2 | Wall Guards (Bumper Guards) | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 10260-1.2 | Door Protectors | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 10260-1.2 | Corner Guards | | | | | | | X | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 10260-1.2 | Wall Guards (Bumper Guards) | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 10260-1.2 | Door Protectors | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 10260-1.2 | Finish | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 10430-1.3 | Exterior Signs | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 10430-1.3 | Exterior Signs | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 10430-1.3 | Exterior Signs | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | 10430-1.3 | Exterior Signs | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 10440-1.3 | Interior Signage | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 10440-1.3 | Interior Signage | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 10440-1.3 | Interior Signage | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 10880-1.2 | Finishes | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 10880-1.2 | Accessory Items | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 10880-1.2 | Finishes | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 10880-1.2 | Accessory Items | | | | | | | | X | | | X | | | | | | | | | | | |
| | | | 10880-1.2 | Electric Hand Dryer | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | 12390-1.3 | Cabinets and Countertops | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | 12390-1.3 | Cabinets and Countertops | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 12390-1.3 | Cabinets and Countertops | | | | | | X | | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | | CONTRACTOR | | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 12390-1.3 | Cabinets and Countertops | | | | | | | | X | | | X | | | | | | | | | | |
| | | | 12540-1.3 | Window Coverings and Hardware | X | | | | | | | | | | | D | | | | | | | | | |
| | | | 12540-1.3 | Window Coverings and Hardware | | X | | | | | | | | | | D | | | | | | | | | |
| | | | 12540-1.3 | Window Coverings and Hardware | | | | | | | | X | | | | D | | | | | | | | | |
| | | | 12540-1.3 | Window Coverings and Hardware | | | | | | | | | | X | | D | | | | | | | | | |
| | | | 13080-1.3 | Bracing and Coupling | X | | | | | | | | | | | D | | | | | | | | | |
| | | | | Lighting Fixtures in Buildings | X | | | | | | | | | | | D | | | | | | | | | |
| | | | | Miscellaneous Equipment | X | | | | | | | | | | | D | | | | | | | | | |
| | | | | Equipment | X | | | | | | | | | | | D | | | | | | | | | |
| | | | | Bracing and Coupling | | X | | | | | | | | | | D | | | | | | | | | |
| | | | | Flexible Couplings or Joints | | X | | | | | | | | | | D | | | | | | | | | |
| | | | | Resilient Vibration Isolation Devices | | X | | | | | | | | | | D | | | | | | | | | |
| | | | | Lighting Fixtures in Buildings | | X | | | | | | | | | | D | | | | | | | | | |
| | | | | Miscellaneous Equipment | | X | | | | | | | | | | D | | | | | | | | | |
| | | | 15250-1.4 | Thermal Insulation Materials | X | | | | | | | | | | X | | | | | | | | | | |
| | | | 15330-1.3 | Sprinkler System Equipment | X | | | | | | | | | | | D | | | | | | | | | |
| | | | | Hydraulic Calculations | X | X | | | | | | | | | | D | | | | | | | | | |
| | | | | Spare Parts | X | | | | | | | | | | X | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | | Sprinkler System Shop Drawings | | X | | | | | | | | | | D | | | | | | | | | | |
| | | | | As-Built Drawings | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | | Test Procedures | | | X | | | | | | | | | D | | | | | | | | | | |
| | | | | Preliminary Tests | | | | X | | | | | | | | D | | | | | | | | | | |
| | | | | Final Test | | | | X | | | | | | | | D | | | | | | | | | | |
| | | | | Installer Qualifications | | | | | X | | | | | | | D | | | | | | | | | | |
| | | | | Submittal Preparer's Qualifications | | | | | X | | | | | | | D | | | | | | | | | | |
| | | | | Contractor's Material and Test Certificate | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | | Sprinkler System O & M | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | 15400-1.5 | Plumbing System | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | | Test, Flushing and Sterilization | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Materials and Equipment | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | | Plumbing System O & M Manuals | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | 15488-1.3 | Qualifications | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Gas Piping System | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | 15569-1.3 | Manufacturer's Catalog Data | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Spare Parts Data | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Water Teatmemt Plan | X | | | | | | | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | | Heating and Fuel Systems Test Proc. | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Welding Procedures | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Qualification | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Welding Qualification | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Heating System | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | | Posted Instructions | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | | Tests | | | | X | | | | | | | X | | | | | | | | | | | |
| | | | | Heating System and Fuel System Tests | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Water Treatment Tests | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Boiler Emissions | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Heating System O & M | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | | Water Treatment O & M | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | 15650-1.3 | Central Refrigerated Air-Conditioning Sys. | X | | | | | | | | | | | D | | | | | | | | | | |
| | | | | Water Treatment System | X | | | | | | | | | | | D | | | | | | | | | | |
| | | | | Central Refrigerated A/C System | | X | | | | | | | | | | D | | | | | | | | | | |
| | | | | Posted instructions | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | | Demonstrations | | | | X | | | | | | | | D | | | | | | | | | | |
| | | | | Field Tests | | | | | | X | | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | | System Performance Tests | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Inspections | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Central Refreigerated A/C System | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | | Operation Manual | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | | Water Treatment System | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | 15895-1.4 | Components and Equipment Data | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Air Supply, Distribution, Ventilation | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | | Test Procedures | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | | Welding Procedures | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | | System Diagrams | | | X | | | | | | | | | D | | | | | | | | | | |
| | | | | Test Schedules | | | | X | | | | | | | X | | | | | | | | | | | |
| | | | | Field Training Schedule | | | | X | | | | | | | X | | | | | | | | | | | |
| | | | | Similar Services | | | | | X | | | | | | | F | | | | | | | | | | |
| | | | | Welding Qualification | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | | Test Reports | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Bolts | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | | Air Supply, Distribution, Ventilation O&M | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | 15950-1.3 | Equipment Compliance Booklet | X | | | | | | | | | | | D | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TITLE AND LOCATION** | | | | **Company Admin Facility** | | | | | | | | | | **CONTRACTOR** | | | | | | Specification Section | | | | | |
| | | | | **Hunter AAF, GA** | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | | HVAC Control System | | X | | | | | | | | | | D | | | | | | | | | | |
| | | | | Commissioning Procedures | | | | | X | | | | | | | D | | | | | | | | | | |
| | | | | Performance Verification Test Procedures | | | | | X | | | | | | | D | | | | | | | | | | |
| | | | | Training Course Materials | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | | Commissioning Report | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Performance Verification Test Procedures | | | | | | X | | | | | | D | | | | | | | | | | |
| | | | | Service Organizations | | | | | | | | | X | | | D | | | | | | | | | | |
| | | | | Operation Manual | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | | Maintenance and Repair Manual | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | 15990-1.4 | Testing and Balancing | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Qualification | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 15995-1.1 | Commissioning Team | X | | | | | | | | | | | D | | | | | | | | | | |
| | | | | Test Procedures | | | X | | | | | | | | | D | | | | | | | | | | |
| | | | | Test Reports | | | | | | X | | | | | | D | | | | | | | | | | |
| | | | 16370-1.3 | Manufacturer's Catalog | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Materials, Equipment and Fixture Lists | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Installation Procedures | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Electrical Distribution System Dwgs. | | X | | | | | | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | | As-Built Drawings | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | | Factory Test Reports | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Field Testing Reports | | | | | | X | | | | | | D | | | | | | | | | | |
| | | | | Test Reports | | | | | | X | | | | | | D | | | | | | | | | | |
| | | | | Materials and Equipment Certificates | | | | | | | X | | | | | D | | | | | | | | | | |
| | | | | Electrical Distribution Sys. O & M | | | | | | | | | | X | X | | | | | | | | | | | |
| | | | 16375-1.3 | Short Circuit and Protective Devices | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Manufacturer's Catalog Data | X | | | | | | | | | | | D | | | | | | | | | | |
| | | | | Materials, Equipment and Fixture Lists | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Installation Procedures | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Electrical Distribution System Dwgs. | | X | | | | | | | | | | D | | | | | | | | | | |
| | | | | As-Built Drawings | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | | Factory Test Reports | | | | | | X | | | | | | D | | | | | | | | | | |
| | | | | Field Testing Reports | | | | | | X | | | | | | D | | | | | | | | | | |
| | | | | Test Reports | | | | | | X | | | | | | D | | | | | | | | | | |
| | | | | Cable Installation Reports | | | | | | X | | | | | | D | | | | | | | | | | |
| | | | | Materials and Equipment Certificates | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | | Electrical Distribution System O & M | | | | | | | | | | X | | D | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 16415-1.3 | Electrical Work Drawings | | X | | | | | | | | | | D | | | | | | | | | | |
| | | | | Materials and Equipment Reports | | | | | | X | | | | | | D | | | | | | | | | | |
| | | | 16640-1.3 | Manufacturer's Catalog Data | X | | | | | | | | | | | D | | | | | | | | | | |
| | | | | Evidence of Qualifications | | | | | | | X | | | | | D | | | | | | | | | | |
| | | | | Detail Drawings | X | | | | | | | | | | | D | | | | | | | | | | |
| | | | 16670-1.3 | Lightning Protection System Dwgs. | | X | | | | | | | | | | D | | | | | | | | | | |
| | | | | Materials and Equipment Certificates | | | | | | | X | | | | | D | | | | | | | | | | |
| | | | 16721-1.4 | Battery | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Voltage Drop | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Spare Parts | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Qualifications | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Fire Alarm Reporting System | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | | Fire Alarm Reporting System | | | X | | | | | | | | | D | | | | | | | | | | |
| | | | | Training | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | | Test Procedures | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | | Testing | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Equipment | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | | Installer | | | | | | | X | | | | X | | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TITLE AND LOCATION | | | | Company Admin Facility | | | | | | | | | | CONTRACTOR | | | | | | Specification Section | | | | | |
| | | | | Hunter AAF, GA | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | 16722-1.3 | Battery | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Spare Parts | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Qualifications | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Fire Alarm Reporting System | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | | Wiring Diagrams | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | | Fire Alarm Reporting System | | | X | | | | | | | | | D | | | | | | | | | | |
| | | | | Training | | | X | | | | | | | | X | | | | | | | | | | | |
| | | | | Test Procedures | | | | | X | | | | | | X | | | | | | | | | | | |
| | | | | Testing | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Equipment | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 16741-1.3 | Spare Parts | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Premises Distribution System | | X | | | | | | | | | | D | | | | | | | | | | |
| | | | | Manufacturer's Recommendations | | | X | | | | | | | | | D | | | | | | | | | | |
| | | | | Test Plan | | | | | X | | | | | | | D | | | | | | | | | | |
| | | | | Qualifications | | | | | X | | | | | | | D | | | | | | | | | | |
| | | | | Test Reports | | | | | | X | | | | | | D | | | | | | | | | | |
| | | | | Premises Distribution System | | | | | | | X | | | | | D | | | | | | | | | | |
| | | | | Materials and Equipment | | | | | | | X | | | | | D | | | | | | | | | | |

| SUBMITTAL REGISTER (ER 415 1-10) | | | | | | | | | | | | | | | | | | Contract No. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TITLE AND LOCATION** | | | | **Company Admin Facility** | | | | | | | | | | **CONTRACTOR** | | | | | | Specification Section | | | | | |
| | | | | **Hunter AAF, GA** | TYPE OF SUBMITTAL | | | | | | | | | CLASSIFICATION | | | CONTRACTOR SCHEDULE DATES | | | CONTRACTOR ACTION | | | GOVERNMENT ACTION | | |
| ACTIVITY NO. | TRANSMITTAL NO. | ITEM NO. | SPECIFICATION PARAGRAPH NUMBER | DESCRIPTION OF ITEM SUBMITTED | DATA | DRAWINGS | INSTRUCTIONS | SCHEDULES | STATEMENTS | REPORTS | CERTIFICATES | SAMPLES | RECORDS | O & M MANUALS | INFORMATION ONLY | GOVERNMENT APPROVED | REVIEWER | SUBMIT | APPROVAL NEEDED BY | MATERIAL NEEDED BY | CODE | DATE | SUBMIT TO GOVERNMENT | CODE | DATE | REMARKS |
| a. | b. | c. | d. | e. | f. | g. | h. | i. | j. | k. | l. | m. | n. | o | p. | q. | r. | s. | t. | u | v. | w. | x. | y. | z. | aa. |
| | | | | Installers | | | | | | | X | | | | | D | | | | | | | | | | |
| | | | 16742-1.3 | Spare Parts | X | | | | | | | | | | X | | | | | | | | | | | |
| | | | | Telephone System | | X | | | | | | | | | X | | | | | | | | | | | |
| | | | | Test Plan | | | | | X | | | | | | | D | | | | | | | | | | |
| | | | | Acceptance Tests | | | | | | X | | | | | X | | | | | | | | | | | |
| | | | | Installation Procedures | | | | | | X | | | | | | D | | | | | | | | | | |
| | | | | Certificates | | | | | | | X | | | | X | | | | | | | | | | | |
| | | | 16781-1.4 | Spare Parts | X | | | | | | | | | | X | | | | | | | | | | | |

*12

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 GENERAL

1.1 REFERENCES:

CORPS OF ENGINEERS (USACE)

EM-200-1-3 (June 1995) Requirements for the Preparation of Sampling and Analysis Plans

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846 (Nov 1986; Rev O) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II)

TEST METHODS

5030/8260 Volatile Organic Compounds

601 Purgeable Halocarbons

1.2 GENERAL REQUIREMENTS:

1.2.1 Description. This section covers Contractor-provided laboratory testing services.

1.2.2 Definitions

(a) Chemical Testing: Chemical testing includes analyses required on soil, water, free product, tank contents or other matrices to determine constituents or chemical properties. These tests are to be performed in a laboratory approved by the Savannah District, Corps of Engineers.

(b) Physical Testing: Physical testing includes tests required to establish the physical properties of a soil. These tests typically include both laboratory and field procedures.

1.3 SUBMITTALS:

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

SD-18, Records

Laboratory Certification, GA.

Contractor shall submit with his bid documents the laboratory name, address, telephone number, and name of responsible officer to the Corps of Engineers. The submittal shall include documentation that the laboratory has been certified by the USACE within 12 months of the submittal date and also approved by Georgia Department of Natural Resources Environmental Protection Division.

Laboratory Quality Assurance/Quality Control Plan; GA

Laboratory shall furnish a written Quality Assurance/Quality Control Plan as part of the SAP.

SD-09 Reports

Laboratory Reports; FIO

Laboratory shall promptly submit two copies of each laboratory report to the Contractor. Include: date issued, project title and number, name of responsible officer, date and time of sampling, type of test, date of test, and results of test, with contract documents. The Laboratory shall provide interpretation of test results when requested by the Corps of Engineers.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 SAMPLING AND TESTING PROGRAM:

The Contractor shall be responsible for the collection of samples required during this work. In all cases, the Contractor shall follow the requirements of EM 200-1-3 (June 1995), and described in the Contractor prepared and submitted SAP. The Contractor shall collect split samples for analysis at a frequency not less than 10 percent of total sample collection and rounded up to the nearest whole number. Contractor may be requested at any time to furnish a replicate or split sample to the Government for QA testing.

3.1.1 Dewatering Water:

The Contractor shall collect samples of both treated and untreated water generated during dewatering and decontamination activities. The frequency of sample collection and parameters requiring analysis shall be detailed in the Sampling and Analysis Plan and shall conform to requirements established in the Georgia Regulations and by the disposal facility. At a minimum, the analysis shall include testing for Purgeable Halocarbons (Method 601).

3.1.2 Potentially Contaminated Soil

The Contractor shall collect one composited sample for every 250 cubic meters of suspected contaminated material but not to be less than one sample from each days worth of excavated material. At a minimum, analysis of this sample shall include testing for VOCs (Method 5030/8260). The Contractor shall be responsible for any additional requirements identified by the disposal facility.

END OF SECTION 01410

*12

SECTION 01420

SAMPLING AND ANALYSIS PLAN AND
ENGINEERING REMEDIATION REPORT FOR COMPLETED HTRW ACTIVITIES

PART 1 **B** GENERAL

1.1 GENERAL REQUIREMENTS: The Contractor shall provide appropriate personnel, time, and equipment to provide a detailed plan for sampling and laboratory analysis of potentially contaminated soil and/or ground water along with a complete report of the activities accomplished and findings developed under this contract should contaminated soil and/or ground water be encountered. In general, the work and report shall be completed under the rules and regulations of the Georgia Department of Natural Resources Environmental Protection Division. The plan and report shall be furnished on 8.5@ x 11@ paper and bound for easy removal and insertion of pages.

1.2 REFERENCES:

ENVIRONMENTAL PROTECTION AGENCY (EPA)

540/G-87/003a Data Quality Objectives for Remedial Response Activities, (Vol. 1, OSWER Directive No. 9335.0-7B).

CORPS OF ENGINEERS (USACE)

ER 200-1-3 Requirements for Preparation of Sampling and Analysis Plans (June 1995)

ENGINEERING MANUALS (EM)

EM 385-1-1 Safety and Health Requirements (September 1996).

1.3 SUBMITTALS: SD-09, Reports

Sampling and Analysis Plan (SAP); GA

The Contractor shall submit an unbound original and 8 bound copies of the draft Sampling and Analysis Plan (SAP).

The Contractor shall submit an unbound original and 8 bound copies of the Final SAP no later than 10 working days after receiving the Government's comments and revisions on the draft document reviewed under this section.

Engineering Remediation Report; GA

The Contractor shall submit an unbound original and 8 bound copies of the Engineering Remediation Report. A draft submittal is not required. Reports shall be submitted to:

Commander
U.S. Army Corps of Engineers
Savannah District
P.O. Box 889
100 W. Oglethorpe Avenue
Savannah, GA 31402-0889

PART 2 **B** EXECUTION

## 2.1 SCOPE

The scope of the reporting shall cover all significant construction, testing, and disposal activities which will have potential for long-term monitoring and/or additional reporting related to the life and history of the contaminants removed from the site. The report shall generally commence with the beginning of actions associated with site preparation for remedial activities through the final disposal at the receiving facility.

## 2.2 ENGINEERING REMEDIATION REPORT

The report shall be formatted by the Contractor as proposed and approved in the work plan. It shall include an Executive Summary, Table of Contents, and narrative chapters or paragraphs for each significant action or operation occurring during the contracted remedial work. The following element shall be included as appendices: Photo documentation of the site work; Quality Control Reports; Visitor Lists; Laboratory analysis; Field Notes; Survey Data; Field Instrument Readings for Chemical Detection; Chain of Custody Documents; Hazardous Waste Manifests; Waste Profile Sheet(s); Land Disposal Restriction Certificates and Notification; Transportation Manifests; Disposal Certificates/Destruction Documents; and a final site map showing the location of the excavated area and cross sections of the pit. The report shall be signed and sealed by a professional engineer or professional geologist registered in the State of Georgia. The report shall be due at the Savannah District office of the Corps of Engineers no later than 45 days after the final site cleanup and departure of the Contractor from the site.

## 2.3 SAMPLING AND ANALYSIS PLAN

A Sampling and Analysis Plan (SAP) will be developed by the Contractor for the sampling and chemical analysis under this contract. The SAP shall be developed to assure that the Contractor collects, analyzes and evaluates chemical data, which are legally and scientifically defensible. The SAP shall be in accordance with provisions covered in EM 200-1-3, "Requirements for Preparation of Sampling and Analysis Plans@ June 1995. A final SAP must be approved prior to initiation of field work. The Corps of Engineers requires that quality control (QC) samples be collected and analyzed by the contract laboratory. These QC samples include splits and replicates of field samples.

### 2.3.1 Preparation of the SAP

The SAP shall consist two sections, a Field Sampling Plan and a Quality Assurance Project Plan:

FIELD SAMPLING PLAN
TITLE PAGE
TABLE OF CONTENTS
- PROJECT DESCRIPTION
- PROJECT ORGANIZATION AND RESPONSIBILITIES
- SCOPE AND OBJECTIVES
- FIELD ACTIVITIES
- SAMPLE CHAIN OF CUSTODY
- SAMPLE PACKING AND SHIPPING
- REFERENCES

QUALITY ASSURANCE PROJECT PLAN
TITLE PAGE
TABLE OF CONTENTS
- PROJECT DESCRIPTION
- PROJECT ORGANIZATION AND RESPONSIBILITIES
- DATA QUALITY OBJECTIVES

SAMPLING LOCATIONS AND PROCEDURES
SAMPLE CUSTODY AND HOLDING TIME REQUIREMENTS
ANALYTICAL PROCEDURES
CALIBRATION PROCEDURES AND FREQUENCIES
INTERNAL QC CHECKS
CALCULATION OF DATA QUALITY INDICATORS
CORRECTIVE ACTIONS
DATA REDUCTION, VALIDATION, AND REPORTING

Each of the above topics will contain the information required by Chapter 3 of EM 200-1-3, November 1994. Required information, in addition to that presented in Chapter 3, is presented in the following paragraphs, along with the corresponding topic under which this information is to appear.

2.3.2 Contract Laboratory Requirements and Analytical Personnel Responsibilities:

The information presented under this heading in EM 200-1-3, Appendix B, Section B-3 shall be incorporated into the SAP in addition to any other information the Contractor believes to be appropriate.

a. Analytical Personnel Responsibilities and Experience Requirement:

The minimum requirements for the chemical quality control officer and bench chemists shall be a baccalaureate in chemistry and 1 year of appropriate experience in preparations, testing, and analyses. In addition, the GC/MS Special Interpretation Expert shall have 3 years' minimum appropriate experience and the Gas Chromatograph Residue Analyses Expert shall have 2 years' minimum appropriate experience. Technicians shall normally have a minimum of high school chemistry. (Technicians shall work under the close and continuous supervision of a chemist and shall be used primarily for sample preparation.)

2.3.3 Sampling and Preservation Procedures

The Contractor shall develop and submit an independently derived sampling/analysis program in his SAP. Preservation of samples shall meet the requirements contained in Appendix I, EM 200-1-3.

a. Soil Sampling Procedure

This sampling procedure shall be described in detail from the sample's extraction from the stockpiles through its placement in the sample containers. Decontaminated stainless steel, Teflon, Teflon coated, or glass sampling equipment shall be used on all equipment which comes into contact with the actual collected sample. Samples that come in contact with any other materials shall be discarded. All volatiles samples shall be collected as grab samples. All quality control samples for volatiles shall be duplicates. Compositing is required for all other analytes, and the method for doing so shall be described.

b. Ground Water Sampling Procedure

This sampling procedure shall be described in detail from the sample's extraction from the ground through its placement in the sample containers. Decontaminated stainless steel, Teflon, Teflon coated, or glass sampling equipment shall be used on all equipment which comes into contact with the actual collected sample. Samples that come in contact with any other materials shall be discarded. All volatiles samples shall be collected as grab samples. All quality control samples for volatiles shall be duplicates. Compositing is required for all other analytes and the method for doing so shall be described.

2.3.4 Laboratory Analytical Procedures

Section 01410 TESTING LABORATORY SERVICES lists the analytical procedures which shall be used.

2.3.5 Chemical Data Quality Management Deliverables:

a. Data Report: The Contractor's analytical data shall be submitted to the USACE as soon as possible after review by the Contractor's chemical QA officer. All raw data shall be stored by the Contractor's or subcontractor's lab for 2 years after project samples have been analyzed. This submittal shall include the below-listed items.

(1) Sample IDs: The Contractor shall prepare a tabular presentation which shall identify all field duplicates and field blanks (including rinsates and trip blanks) as such. This table shall also match all rinsates with their corresponding field samples as well as matching each trip blank with the samples that accompanied it during shipment.

(2) Sample Receipt: The Contractor shall complete and report a "Cooler Receipt Form" for all shipments for purposes of noting problems in sample packaging, chain-of-custody, and sample preservation.

b. Internal Quality Control Reporting: The SAP shall confirm that the following information shall be included:

(1) Laboratory Blanks (Method Blanks and Instrument Blanks): All analytes shall be reported for each laboratory blank. All nonblank sample results shall be designated as corresponding to a particular laboratory blank in terms of analytical batch processing.

(2) Surrogate Spike Samples: Surrogate spike recoveries shall be reported with all organic method reports where appropriate (i.e. when the method requires surrogate spikes). The report shall also specify the control limits for surrogate spike results as well as the spiking concentration. Any out-of-control recoveries (as defined in the specified method) shall result in the sample being rerun at no additional cost to the Government (both sets of data are to be reported). Should the samples be too old, of insufficient quantity, etc., new samples will be collected and analyzed at no additional cost to the Government.

(3) Matrix Spike Samples: Matrix spike recoveries shall be reported for all organic and inorganic analyses. All general sample results shall be designated as corresponding to a particular matrix spike sample. The report shall indicate what field sample was spiked even if it was not a Corps of Engineers project sample. The report shall also specify the control limits for matrix spike results for each method for each matrix.

(4) Laboratory Duplicates and/or Matrix Spike Duplicate Pairs: Relative percent difference shall be reported for all duplicate pairs as well as analyte/matrix specific control limits.

(5) Laboratory Control Standards (LCS): When run for internal quality control, Laboratory Control Standards results shall be reported with the corresponding field sample data. Control limits for LCSs shall also be specified.

c. Field Duplicates and Field Blanks: These samples shall be identified as such by the Contractor and reported as any other field sample. Relative percent differences shall be reported for all field duplicate pairs.

END OF SECTION

SECTION 01440

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM D 3740 | (1992) Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction |
| ASTM E 329 | (1993b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction |

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Schedule (Section 00010).

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the contract clause entitled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with quality requirements specified in the contract. The project superintendent in this context shall mean the individual with the responsibility for the overall management of the project including quality and production.

3.2 QUALITY CONTROL PLAN

3.2.1 General

The Contractor shall furnish for review by the Government, not later than 5 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the contract clause entitled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation.

Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a complete CQC Plan.

3.2.2 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters will also be furnished to the Government.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off-site fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01300 SUBMITTAL PROCEDURES.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and has separate control requirements. It could be identified by different trades or disciplines, or it could be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the coordination meeting.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified. Determinations of the Contracting Officer or his authorized representative regarding the acceptability of the qualifications of proposed CQC personnel are final and not subject to action under the Disputes clause.

3.2.4 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. The CQC Plan shall be submitted for review a minimum of 7 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and off-site work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 General

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure contract compliance. The Contractor shall provide a CQC organization which shall be at the site at all times during progress of the work and with complete authority to take any action necessary to ensure compliance with the contract. All CQC staff members shall be subject to acceptance by the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within his organization at the site of the work who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a construction person with a minimum of 10 years' experience in related work. This CQC System Manager shall be on the site at all times during construction and will be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager will be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate will be the same as for the designated CQC System Manager.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: mechanical,

submittals clerk. These individuals may be employees of the prime or subcontractor; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals may perform other duties but must be allowed sufficient time to perform their assigned quality control duties as described in the Quality Control Plan.

Experience Matrix

| Area | Qualifications |
|---|---|
| Mechanical | Person with 10 years' related experience |
| Submittals | Submittal Clerk with 3 year's experience |

3.4.4 Additional Requirement

In addition to the above experience and education requirements, the CQC System Manager or the principal member of the CQC staff shall have completed the course entitled "Construction Quality Management." This course is offered on a quarterly basis within the Savannah District boundaries. CQC system Managers who have not successfully completed this course must attend the next available training session. Failure to successfully complete this training within the next available training date will be grounds for removal as CQC System Manager.

3.4.5 Organizational Changes

The Contractor shall maintain his CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS

Submittals shall be made as specified in Section 01300 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. The controls shall be adequate to cover all construction operations, including both onsite and off site fabrication, and will be keyed to the proposed construction sequence. The controls shall include at least three phases of control to be conducted by the CQC System Manager for all definable features of work, as follows:

3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work and shall include:

a. A review of each paragraph of applicable specifications.

b. A review of the contract drawings.

c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

g. A review of the appropriate activity hazard analysis to assure safety requirements are met.

h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

j. Discussion of the initial control phase.

k. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications and familiarize all workers with the safety precautions developed in the activity hazard analysis.

3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon or conceal non-conforming work.

3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if the quality of on-going work is unacceptable, if there are changes in the applicable CQC staff, onsite production supervision or work crew, if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

The Contractor shall perform tests specified or required to verify that control measures are adequate to provide a product which conforms to contract requirements. Testing includes operation and/or acceptance tests when specified. It also requires that all mechanical and electrical testing procedures, specified or required to demonstrate satisfactory system performance, be described in the CQC Plan in detail and approved prior to performing actual work. Where technical specifications require recording of test data, proposed test log, including planned duration of test, readings to be taken, and instrumentation to be used, will be made a part of the CQC Plan. In all other instances, Contractor shall submit for approval appropriate forms to document each test performed. Tests of air-conditioning systems, boilers, chillers, and the like, would be covered as described above. The Contractor shall procure the services of a commercial testing laboratory or establish a testing laboratory at the project site. Testing laboratories must be inspected and approved by the Corps of Engineers. A list of tests to be performed shall be furnished as a part of the CQC plan. The list shall give the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of test, and an estimate of the number of tests required. The Contractor shall perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Results of all tests taken, both passing and failing tests, will be recorded on the Quality Control report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test will be given. Actual test reports may be submitted later, if approved by the Contracting Officer, with a reference to the

test number and date taken. An information copy of tests performed by an off site or commercial test facility will be provided directly to the Contracting Officer. Test results will include all supporting computations. Failure to submit timely test reports, as stated, may result in nonpayment for related work performed and disapproval of the test facility for this contract.

3.7.2 Testing Laboratories

3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

3.7.3 On-Site Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials will be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

| | |
|---|---|
| For delivery by mail: | P.O. Box 51<br>Marietta, GA 30061 |
| For other deliveries: | 611 South Cobb Drive<br>Marietta, GA 30060-3112 |

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

3.8 COMPLETION INSPECTION

3.8.1 Pre-Final Inspection

At the completion of all work or any increment thereof established by a completion time stated in the Special Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the CQC System Manager shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings and specifications. Such a list of deficiencies shall be included in the CQC documentation, as required by paragraph DOCUMENTATION below, and shall include the estimated date by which the deficiencies will be corrected. Once this is accomplished the Contractor shall notify the Government that the facility is complete and is ready for the Government's "Prefinal" inspection. The Government will perform this inspection to verify that the facility is complete and ready to be occupied. A Government "Prefinal Punch List" will be

developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected and so notify the Government so that a "Final" inspection with the customer can be scheduled. Any items noted on the "Final" inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph will be accomplished within the time slated for completion of the entire work or any particular increment thereof if the project is divided into increments by separate completion dates.

3.8.2 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, his superintendent or other primary management person and the contracting Officer's representative will be in attendance at this inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon notice from the Contractor. This notice will be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and must include the Contractor's assurance that all specific items previously identified to the Contractor as being acceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause entitled "Inspection of Construction."

3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

a. Contractor/subcontractor and their area of responsibility.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals reviewed, with contract reference, by whom, and action taken.

g. Off-site surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and/or specifications.

j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date(s) covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every seven days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

## 3.10 SAMPLE FORMS

Sample forms are included in Attachment 1 of Section 00800.

## 3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the worksite, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

-- End of Section --

CEGS-01500/S (February 1997)

SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES
**02/97**

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Site Plan

The Contractor shall prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Any areas which may have to be graveled to prevent the tracking of mud shall also be identified. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

1.1.2 Identification of Employees

The Contractor shall be responsible for furnishing to each employee, and for requiring each employee engaged on the work to display, identification as approved and directed by the Contracting Officer. Prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employee. When required, the Contractor shall obtain and provide fingerprints of persons employed on the project. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

1.1.3 Employee Parking

Contractor employees shall park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking shall not interfere with existing and established parking requirements of the military installation.

1.2 AVAILABILITY AND USE OF UTILITY SERVICES

1.2.1 Payment for Utility Services

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

1.2.2 Meters and Temporary Connections

The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary connections, distribution lines, and meter bases (Government will provide

meters) required to measure the amount of each utility used for the purpose of determining charges. The Contractor shall notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Government will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation. The Contractor shall not make the final electrical connection.

1.2.3 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of $50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed to the Contractor prior to the end of the current fiscal year.

1.2.4 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading, disconnect service, and remove the meters. The Contractor shall then remove all the temporary distribution lines, meter bases, and associated paraphernalia. The Contractor shall pay all outstanding utility bills before final acceptance of the work by the Government.

1.2.5 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

1.2.6 Telephone

The Contractor shall make arrangements and pay all costs for telephone facilities desired.

1.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.3.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

1.3.2 Project Signs

The Contractor shall furnish and install a project sign at the location selected by the Contracting Officer. The project sign shall be painted on 1/2 inch thick exterior grade plywood. The sign layout shall be in accordance with the graphic format shown in Attachment 1 to Section 00800. The 4' by 4' right-hand section shall be painted white (Color No. 37875, Fed. Std. 595a) with black (Color No. 37038, Fed. Std. 595a) lettering. The 2' by 4' left-hand section shall be painted red (Color No. 12199, Fed. Std. 595a) with white lettering. Eight additional signs of similar construction and finish shall be furnished and installed at locations selected by the Contracting Officer. These signs shall be 36 inches wide, 15 inches high, with red letters 2 inches high on a white background and shall read as follows:

"OFF LIMITS TO UNAUTHORIZED PERSONNEL"

## 1.4 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

### 1.4.1 Haul Roads

The Contractor will be required to use the haul routes shown on the plans unless otherwise permitted in writing by the Contracting Officer. When haul routes are not designated on the plans, the Contractor must obtain approval of the Contracting Officer of haul routes he intends to use. The Contractor shall maintain the haul routes and shall keep the dust problem under control by wetting the surface as needed. Sweeping and cleaning of pavements will be done as necessary to remove spillage resulting from the hauling operations. After all hauling has been completed, the Contractor shall restore the earth areas used for the haul routes to original condition by final grading, shaping, compacting, and grassing, and shall clean and sweep all paved areas as required. Any pavement damaged as a result of hauling operations under this contract for both the earth and other materials shall be promptly repaired by the Contractor, as approved by the Contracting Officer. The cost of maintenance and repair of the haul routes, as mentioned above, shall be considered as a subsidiary obligation of the Contractor. The axle load of earth hauling equipment operating on paved streets shall not exceed 12,000 pounds.

### 1.4.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe public access to paved areas such as roads, parking areas or

sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

## 1.5 CONTRACTOR'S TEMPORARY FACILITIES

### 1.5.1 Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

### 1.5.2 Storage Area

The Contractor shall construct a temporary 6 foot high chain link fence around trailers and materials. The fence shall include plastic strip inserts, colored brown, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

### 1.5.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

### 1.5.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the military property.

### 1.5.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass

located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

1.5.6 New Building

In the event a new building is constructed for the temporary project field office, it shall be a minimum 12 feet in width, 16 feet in length and have a minimum of 7 feet headroom. It shall be equipped with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. It shall be provided with a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building shall be waterproof, shall be supplied with heater, shall have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities shall be furnished. The windows and doors shall be screened and the doors provided with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. In warm weather, air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 20 degrees F below the outside temperature when the outside temperature is 95 degrees F, shall be furnished. Any new building erected for a temporary field office shall be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work shall become the property of the Contractor and shall be removed from the site. All charges for telephone service for the temporary field office shall be borne by the Contractor, including long distance charges up to a maximum of $75.00 per month.

1.5.7 Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

1.6 OMITTED

1.7 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor shall install a satisfactory means of communication, such as telephone or other suitable devices. The devices shall be made available for use by Government personnel.

1.8 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing at the work site. The safety fencing shall be a high visibility brown colored, high density polyethylene grid or approved equal, a minimum of 42 inches high, supported and tightly

secured to steel posts located on maximum 10 foot centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

## 1.9 PARTNERING

Following contract award, the Government intends to propose a voluntary partnering relationship with the Contractor. This partnering relationship will attempt to draw on strengths of each organization to facilitate communications and minimize delays to achieve a quality product, within budget, and on schedule. Participation in such partnering activities may include attendance at coordination meetings and cooperation in other efforts to promote the partnering relationship. The Government and the Contractor will each bear their own costs for participation in the partnering relationship, with no change in the contract price. Participation will not result in any change in the terms or price of the contract.

## 1.10 INSTALLATION REGULATIONS

The employees of the Contractor will be required to abide by all installation regulations as published by the Commanding Officer. A copy of these regulations can be obtained from the Area/Resident Engineer at the installation. All costs in connection therewith shall be included in the contract price for the work. All costs in connection therewith shall be included in the contract price for the work.

## 1.11 "AS-BUILT" RECORD DRAWINGS - MILITARY

### 1.11.1 Master Prints

The Contractor shall be responsible for maintaining one set of master prints on the job site, on which he shall keep a careful and neat record of all deviations from the original contract drawings which are made to each phase of construction as the work progresses. The Contractor is responsible for noting all changes and corrections on these record drawing prints promptly as the changes occur, but in no case less often than on a weekly bases. The record drawing prints which are maintained shall indicate all changes and modifications incorporated into the work as well as the following:

#### 1.11.1.1 Subsurface Utility Lines

Actual location of all subsurface utility lines. Type of materials actually installed, major sizes of lines, etc. In order that the locations of these lines and appurtenances may be determined in the event the surface openings or indicators become covered or obscured, the record drawings shall show, by offset dimensions to two permanently fixed surface features, both ends of each run each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensions along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

#### 1.11.1.2 Shop Drawings

Any shop drawings which constitute part of the design shall be included with the record drawings.

1.11.1.3 Manufacturer and Model Number

The manufacturer and model number of all major items of equipment shall be shown on the record drawings.

1.11.1.4 Unawarded Additives

Upon completion of all construction, the Contractor will delete all references to unawarded additives shown on the contract drawings.

1.11.2 Certification

These notated prints shall be certified as to their correctness by the signature of an authorized representative of the Contractor and turned over to the Administrative Contracting Officer not later than 10 days after acceptance of the work by the Government. Marked up prints shall be reviewed for approval by the Administrative Contracting Officer and returned to the Contractor for any corrections necessary (Set A).

1.11.3 Duplicate Prints

Upon acceptance of the original set of master prints, a second set of duplicate prints shall be marked up by the Contractor depicting all notations approved on the original set of certified master prints (Set B). Changes noted on the second set of prints should be verified and certified as to their correctness by the signature of an authorized representative of the Contractor. Immediately upon completion of this work, both sets of marked up prints shall be returned to the Administrative Contracting Officer for distribution.

1.11.4 Distribution

After receipt of the two sets of marked up prints by the Administrative Contracting Officer, distribution of the prints shall be made in accordance with the following guidelines:

Set A - Provide to the user of facility (DPW or BCE)

Set B - Provide to Savannah District Office - Construction Division ATTN: CESAS-CD-CE

1.11.5 Final "As-built" Drawings

Final "revised as-built drawings" will be made by the Construction Division by transferring all corrections the Contractor has noted on the marked up prints to the "original contract drawings."

1.11.6 Installed Equipment List

Provide installed equipment list to the Contracting Officer not later than 30 calendar days prior to the contract completion date. The list shall be submitted in original and four copies. The data required for each item of equipment shall include the item description, capacity, model number, manufacturer's name, telephone number, and address, including local supplier and cost. The equipment included shall, as a minimum, conform to the categories found on the "Real Property Inventory" list in Section 00800, Attachment 1, and shall include all specialty equipment provided in the contract. The proposed equipment list shall be submitted to the

Contracting Officer for approval. This list is in addition to the data required in operation and maintenance manuals.

1.12 OMITTED

1.13 OMITTED

1.14 ENVIRONMENTAL EVALUATION FOR SITE CONTAMINATION - CATEGORY II

1.14.1 Site Evaluation

The job site has been evaluated for potential site contamination. The site is perceived as a clean location which has the potential for contamination.

1.14.2 Site Analysis

The Government analysis of the current site conditions is as follows: contaminated ground water.

An environmental investigation of the site indicated that the soil is clean with no VOCs, SVOCS, or TPH detected; however, low amounts of metals were detected at concentrations below state-defined action levels. The ground water contained low concentrations of metals at levels below the state-defined action level. However, elevated levels of solvents exceeding state-defined action levels were detected in each groundwater sample.

The project site appears acceptable for construction provided excavation and construction activities do not encounter the groundwater, which was located at a depth of 2 to 2.4 meters below the ground surface at the time of the geotechnical and environmental investigations. Should construction activities encounter the groundwater, special HTRW measures, including personal protective equipment (PPE) and health monitoring might be required for construction personnel.

A description of and results of the environmental investigation are available for review at the Savannah District Office. Contact the Project Manager, Ms. Beth Shields at (912)-652-5664 to review the information.

1.14.3 Contractual Responsibilities of All Parties in Addressing Discovery of Contamination

The Contractor shall conduct continual air monitoring of all excavations for foundations and utility systems utilizing a Combustible Gas Indicator (CGI) and either a Flame Ionization Detector (FID) or a Photo Ionization Detector (PID). Action levels shall be as follows:

Combustible Gas Indicator (CGI) Action Levels: Taken immediately above (within 150 mm) of the excavation.

Oxygen at <19.5 percent
Oxygen at >23.0 percent

Lower Explosive Limit is 20 percent and rising. Evacuate area until levels drop below 20 percent.

Flame Ionization Detector (FID) Action Levels: Concentration at 5 ppm in the breathing zone.

Photo Ionization Detector (PID) Action Levels: A sustained level of 5 PID

units in the breathing zone.

Due to the possible pressure of volatile hydrocarbons at the site, all Contractor personnel shall vacate the excavation vicinity should organic readings of 5 ppm or 5 PID units be obtained. If the organic readings have dropped below the 5 ppm/5 PID units threshold upon sampling the area following a period of 15 minutes, excavation may resume with continued air monitoring. If the organic readings remain above the 5 ppm/5 PID units threshold upon resampling, the Contractor shall stop all work on the job site and report the discovery to the Contracting Officer's Representative (COR). The COR will issue a written order to the Contractor to resume work or to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government as provided in FAR 52.212-12 - SUSPENSION OF WORK. The Government will be responsible for making an assessment of the contaminated site if this course of action is determined to be appropriate. After the assessment has been completed, the Government reserves the right to the following courses of action:

a. Direct the Contractor to resume work.

b. Clean up the contaminated site prior to directing the Contractor to resume work. The COR will determine whether the cleanup is to be accomplished by others or the Contractor.

c. Relocate the project site.

d. Terminate the contract for the convenience of the Government as provided in FAR 52.249-1 - TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) (SHORT FORM) or FAR 52.249-2 - TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (FIXED-PRICE) - ALTERNATE I as applicable.

1.15 OMITTED
1.16 OMITTED
1.17 OMITTED
1.18 OMITTED
1.19 OMITTED

1.20 CONSTRUCTION SCHEDULE RESTRAINTS - HUNTER AAF, GA

1.20.1 Occupancy

It is the intent of these provisions to provide for maximum coordination between construction activities pursuant to this contract and concurrent ongoing routine activities of base personnel. Interference with and inconvenience to the occupants or routine of the facility shall be held to an absolute minimum.

1.20.2 Protection

Contractor is responsible to provide such covering, shields and barricades as are required to protect building occupants, equipment, stores, supplies, etc., from dust, debris, weather intrusion, water, moisture or other cause of damage resulting from construction.

1.20.3 Phasing and Sequence

1.20.3.1 General

In addition to the submittals required by clause SCHEDULES FOR CONSTRUCTION CONTRACTS (see SECTION 00700, FAR 52.236-15) the Contractor shall submit for approval a summary work schedule setting forth schedule dates for initiation and completion of construction in each work area. No work shall be performed prior to approval of this schedule and all work shall be performed in strict adherence thereto. If departures from this schedule appear to be required or desired, the Contracting Officer shall be promptly notified and his approval will be required prior to implementation of said departure(s).

1.20.3.2 Special Work Restraints

None.

1.20.4 Time of Performance

1.20.4.1 Access to Buildings

All work requiring access to building interiors excluding attics, crawl spaces, etc., and all other work shall be performed between 7:30 a.m. and 4 p.m. (normal working hours for base where project is located) excluding official holidays, unless otherwise indicated or approved by the Contracting Officer. Requests to work during other than these normal hours shall be made in writing at least 36 hours in advance. For example, a request to work on a Saturday shall be submitted no later than Thursday at noon.

1.20.4.2 Work Requiring Outages

Work requiring outages of utilities or building systems will be accomplished during normal working hours in accordance with prior approved schedule(s).

1.20.5 Time of Performance

Contractor's work requiring outages of utility systems or building systems will require 2 weeks' advance notice and will be subject to the approval of the Contracting Officer. Notice shall include type of outage, date, and time outage will commence and estimated duration of outage.

1.20.6 Continuity

All tools, labor and materials required to complete any item of work within a given work area or requiring an outage of any building utility or system, shall be available at the site prior to commencement thereof. Once work has commenced on an item of work, said work shall be continuously and diligently performed to completion and acceptance.

1.20.7 Excavation Permits

Excavation permits will require 1 week's advance written notice and will be subject to the Contracting Officer's approval. Notice shall be accompanied with a sketch showing the location of the proposed excavation.

1.20.8 Road and/or Railroad Closures

Road and/or railroad closures will require 2 weeks' advance written notice and be subject to the Contracting Officer's approval. Notice shall state

reason for closure, date and time closure will commence and estimated duration of closure. A sketch shall be provided showing location of excavated area and placement of barricades and signs. Closures shall be limited to a maximum of 5 calendar days.

1.20.9 Entry

Entry to all areas to be coordinated with the Provost Marshal's office, Traffic Division, Building 1251.

1.21 OMITTED
1.22 OMITTED
1.23 OMITTED
1.24 OMITTED
1.25 OMITTED
1.26 OMITTED
1.27 OMITTED

1.28 PROGRESS PHOTOGRAPHS

The Contractor shall, during the progress of the project, furnish the Contracting Officer progress photographs and color slides to depict progress of construction. The photographic work shall be performed by a qualified, established, commercial photographer. The photographs and slides shall be taken between the first and fifth day of each month and be delivered to the Contracting Officer not later than the 20th day of the same month taken. The photographs and slides shall be taken from not less than six positions for each month as selected by the Contracting Officer. They shall show, inasmuch as practicable, work accomplished during the previous month. The photographs shall be 8-inch by 10-inch color glossy prints and the slides 35 millimeter color slides. Each photograph shall be identified showing date made, contract title and number and a brief description of work depicted and shall be sequentially numbered. The identifying data shall be placed on the back of the prints. Slides shall have a number placed on the frame corresponding to the appropriate identified print, the name of the project, the date and a brief description of work depicted. No identifying data shall appear on the face of prints or in the viewing area of slides. One copy of each photograph and the corresponding negative and slide shall be furnished to the Contracting Officer by the time stipulated above. No separate payment will be made for these services and all costs in connection therewith shall be considered incidental to costs of the overall project.

1.29 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

1.30 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor

for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION 02012

ENVIRONMENTAL PROTECTION

1. SCOPE: This section covers prevention of environmental pollution and damage as the result of construction operations under this contract and for those measures set forth in other Technical Provisions of these specifications. For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to man; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, and land, and includes management of visual aesthetics, noise, solid waste, radiant energy and radioactive materials, as well as other pollutants.

2. QUALITY CONTROL: The Contractor shall establish and maintain quality control for environmental protection of all items set forth herein. The Contractor shall record on daily reports any problems in complying with laws, regulations and ordinances and corrective action taken.

3. PERMITS OBTAINED BY THE CORPS OF ENGINEERS: The Contractor shall comply with all requirements under the terms and conditions set out in the following permit obtained by the Corps of Engineers as required by the State of Georgia Environmental Protection Agency.

4. SUBMITTALS: The Contractor shall submit an Environmental Protection Plan in accordance with provisions as herein specified.

4.1 Environmental Protection Plan shall include but not be limited to the following:

(1) A list of Federal, State and local laws, regulations, and permits concerning the environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations and permits.

(2) Methods for protection of features to be preserved within authorized work areas. The Contractor shall prepare a listing of methods to protect resources needing protection, i.e., trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality fish and wildlife, soil, historical, archeological and cultural resources.

(3) Procedures to be implemented to provide the required environmental protection and to comply with the applicable laws and regulations. The Contractor shall set out the procedures to be followed to correct pollution of the environment due to accident, natural causes or failure to follow the procedures set out in accordance with the environmental protection plan.

(4) Permit or license and the location of the solid waste disposal area.

(5) Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials.

(6) Environmental monitoring plans for the job site, including land, water, air, and noise monitoring.

(7) Traffic Control Plan: Refer to SPECIAL CLAUSES of the specifications.

(8) Methods of protecting surface and ground water during construction activities.

(9) Work area plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas.

(10) Plan of Borrow Area(s):

4.2 IImplementation: After receipt of Notice to Proceed, the Contractor shall submit in writing the above Environmental Protection Plan within the time specified under the SPECIAL CLAUSES. Approval of the Contractor's plan will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and other environmental protection measures.

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

6. NOTIFICATION: The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the aforementioned Federal, State or local laws or regulations, permits and other elements of the Contractor's Environmental Protection Plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action as may be approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspension.

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

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

7.1.1 Work Area Limits: Prior to any construction the Contractor shall mark the areas that are not required to accomplish all work to be performed under

this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects.

7.1.2 Protection of Landscape: Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques.

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

7.1.4 Temporary Protection of Disturbed Areas: Such methods as necessary shall be utilized to effectively prevent erosion and control sedimentation, including but not limited to the following:

(1) Retardation and Control of Runoff: Runoff from the construction site shall be controlled by construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses, and any measures required by area-wide plans approved under paragraph 208 of the Clean Water Act.

(2) Sediment Basins: Sediment from construction areas shall be trapped in temporary or permanent sediment basins in accordance with basin plans shown o the drawings. The basins shall accommodate the runoff of a local ~~[design year]~~ design year storm. After each storm the basins shall be pumped dry and accumulated sediment shall be removed as necessary to maintain basin effectiveness. Overflow shall be controlled by paved weir or by vertical overflow pipe, draining from the surface. The collected topsoil sediment shall be reused for fill on the construction site, and/or conserved (stockpiled) for use at another site(s). The Contractor shall institute effluent quality monitoring programs as required by the State and local environmental agencies.

*2

7.1.5 Erosion and Sedimentation Control Devices: The Contractor shall construct or install all temporary and permanent erosion and sedimentation control features as indicated on the drawings. Temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.

7.1.6 Location of Field Offices, Storage and Other Contractor Facilities: The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings. Temporary movement or relocation of Contractor facilities shall be made only on approval by the Contracting Officer.

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

7.1.8 Spoil areas on Government property shall be managed and controlled to limit spoil to areas designated on the drawings and prevent erosion of soil or sediment from entering nearby water courses or lakes. Spoil areas shall be developed in accordance with grading specifications of the TECHNICAL PROVISIONS.

7.1.9 Temporary excavations and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment.

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

7.1.10.1 Disposal of Solid Waste by Removal from Government Property: The Contractor shall transport all solid waste off Government property and dispose of it in compliance with Federal, State, and local requirements for solid waste disposal.

7.1.11 Disposal of Chemical Waste: Chemical waste shall be stored in corrosion-resistant containers, removed from the work area and disposed of in accordance with Federal, State and local regulations.

7.1.12 Disposal of Discarded Materials: Discarded materials other than those which can be included in the solid waste category will be handled as directed by the Contracting Officer.

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

7.3 Protection of Water Resources: The Contractor shall keep construction activities under surveillance, management and control to avoid pollution of surface and ground waters. Special management techniques as set out below shall be implemented to control water pollution by construction activities which are included in this contract.

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

7.3.2 Cofferdam and Diversion Operations: The Contractor shall plan his operation and perform all work necessary to minimize adverse impact or violation of the water quality standard for ~~[insert name of water areas].~~ Savannah, Georgia. Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure shall be controlled at all times to limit the impact of water turbidity on the habitat for wildlife and impacts on water quality for downstream use.

*2

7.3.3 Stream crossings shall be controlled during construction. Crossings shall provide movement of materials or equipment which do no violate water pollution control standards of the Federal, State or local government.

7.3.4 Limit excavation below ground water, water table to a minimum. When ground water is encountered contractor shall abide by Georgia Environmental Protection Act.

7.3.5 Monitoring of water areas affected by construction activities shall be the responsibility of the Contractor. All water areas affected by construction activities shall be monitored by the Contractor.

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

7.5 Protection of Air Resources: The Contractor shall keep construction activities under surveillance, management and control to minimize pollution of air resources. All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with the State of Georgia Environmental Protection Agency, and all Federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained for those construction operations and activities specified in this section. Special management techniques as set out below shall be implemented to control air pollution by the construction activities which are included in the contract.

7.5.1 Particulates: Dust particles, aerosols, and gaseous by-products from all construction activities, processing and preparation of materials, such as from asphaltic batch plants, shall be controlled at all times, including weekends, holidays and hours when work is not in progress.

7.5.1.1 Particulates Control: The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards mentioned in Paragraph 7.5 above to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times. The Contractor must have sufficient competent equipment available to accomplish this task. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

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

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

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

7.6 Protection of Sound Intrusions: The Contractor shall keep construction activities under surveillance, and control to minimize damage to the environment by noise. The Contractor shall use methods and devices to control noise emitted by equipment to the levels shown in Table 32-1, Section 32, EM 385-1-1, U.S. Army Corps of Engineers Safety and Health Requirements Manual and as required by local or State regulations.

8. POST CONSTRUCTION CLEANUP: The Contractor shall clean up areas used for construction. Construction site shown on drawings as project location.

9. RESTORATION OF LANDSCAPE DAMAGE: The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be in accordance with the plan submitted by the Contractor for approval by the Contracting Officer. This work will be accomplished at the Contractor's expense.

10. MAINTENANCE OF POLLUTION CONTROL FACILITIES: The Contractor shall maintain all constructed facilities and portable pollution control devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

11. TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL: The Contractor shall train his personnel in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental pollution control.

12. PAYMENT: No separate payment or direct payment will be made for the cost of the work covered under this section, and such work will be considered as a subsidiary obligation of the Contractor.

End of Section

SECTION 02050

DEMOLITION

INDEX

PART 1 GENERAL

1.1 OMITTED

1.2 GENERAL REQUIREMENTS

1.3 SUBMITTALS

1.4 DUST CONTROL

1.5 PROTECTION

1.5.1 Protection of Existing Property

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of conservation, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as specified.

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

SD-18 Records

Work Plan; GA.

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations.

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

Before beginning any demolition work, the Contractor shall carefully survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take all necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government, and any damaged items shall be repaired or replaced as approved by the Contracting Officer at no additional cost to the Government. The Contractor shall carefully coordinate the work of this section with all other work and shall construct and maintain shoring, bracing

and supports, as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.5.2 Protection From the Weather

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

1.5.3 Protection of Trees

Trees within the project site which might be damaged during demolition and which are indicated to be left in place shall be protected by a 6-foot high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the Contracting Officer.

1.5.4 Environmental Protection

The work shall comply with the requirements of Section 02011.

1.6 BURNING

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

1.7 USE OF EXPLOSIVES

Use of explosives will not be permitted.

1.8 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available in accordance with the following schedule:

| Area | Date |
|---|---|
| Entire Building Site | From Beginning of Construction (“Notice to proceed”) through completion of the project. 7:00 A.M. - 7:00 P.M. Monday - Sunday |

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXISTING STRUCTURES

Existing structures indicated shall be removed by others and is not in this contract. Sidewalks, curbs, gutters and wood utility pole shall be removed as indicated.

3.2 UTILITIES

Disconnections of utility services, with related meters and equipment, are specified in Section 02660. Existing utilities shall be removed as indicated. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area.

## 3.3 FILLING

Holes, open basements and other hazardous openings shall be filled in accordance with Section 02221.

## 3.4 DISPOSITION OF MATERIAL

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

### 3.4.1 Salvageable Items and Materials

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

#### 3.4.1.1 Material Salvaged for the Contractor

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

#### 3.4.1.2 Omitted

#### 3.4.1.3 Omitted

#### 3.4.1.4 Historical Items

Historical items shall be removed in a manner to prevent damage. The following historical items shall be delivered to the Government for disposition: Artifacts uncovered by discovery during excavation and grading process.

### 3.4.2 Unsalvageable Materials

All materials shall be disposed of as noted on Sheet C-1. The fill in the disposal area shall be disposed of in a county approved land fill. There is no disposal area on Hunter AAF Post. All unsalvageable materials become the property of the contractor and it is the responsibility of the contractor to properly dispose of material off Post.

## 3.5 CLEANUP

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

-- End of Section --

SECTION 02059

REMOVAL OF BUILDING FOUNDATIONS, PAVEMENTS, AND DRAINAGE STRUCTURES

1. SCOPE: This section covers the removal and disposal of building foundations, pavements, and drainage structures that may be encountered during
*2 the grading of ~~[roadways,] [parking areas,] [airfields,] [railroads,] and [building sites],~~ roadways, parking areas and building sites.

2. DEFINITIONS:

2.1 Building Foundations: Building foundations include footings, piers, foundations, slabs, chimneys, steps, coal boxes and other discarded building materials and debris remaining after salvage and demolition have been completed in accordance with SECTION: DEMOLITION.

2.2 Pavements: Pavements include concrete and bituminous pavement, concrete sidewalks, concrete curbing, and concrete curb and gutter.

2.3 Drainage Structures: Drainage structures include drainage pipe, inlets, manholes and headwalls.

3. REMOVAL AND DISPOSAL:

3.1 The items to be removed, as specified hereinbefore and indicated on the plans, shall be removed within the limits shown on the plans as necessary to facilitate construction of the individual facility. The removed foundations, pavements and drainage structures as defined above, shall be broken into pieces not exceeding 24 inches in either dimension and disposed of offsite and off Hunter AFF Base and on to an approved landfill for the material removed. All holes and depressions and other surface irregularities resulting from the removal operations shall be backfilled, compacted and restored to original surrounding surface in conformance with the grading section of the specifications.

3.2 Salvable Materials: Drainage structures, frames, tops, grates and removed pipe deemed salvable by the Contracting Officer shall remain the property of the Using Service, and shall be stockpiled as directed.

4. DUST CONTROL: The amount of dust resulting from the removals shall be controlled to prevent the dust from spreading and creating a nuisance in the surrounding area, as specified in SECTION: ENVIRONMENT PROTECTION.

5. QUALITY CONTROL: During construction, an established system of quality control shall be maintained. To assure compliance with contract requirements and the maintenance of records of all materials, equipment and construction operations, quality control shall include but not be limited to the following:

Safety requirements
Restoring ground surface to original surrounding surface
Disposal requirements
Dust control

A copy of all records required herein, and the records of corrective action taken, shall be furnished the Contracting Officer.

End of Section

SECTION 02110

CLEARING AND GRUBBING

PART 1 GENERAL

1.1 *OMITTED*

1.2 DEFINITIONS

1.2.1 Clearing

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

1.2.2 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 75 millimeters (3 inches) in diameter, and matted roots from the designated grubbing areas.

1.3 SUBMITTALS

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

SD-18 Records

Materials including Salable Timber and Palm Trees.

Written permission to dispose of such products on private property shall be filed with the Contracting Officer.

*6 1.4 ~~MEASUREMENT~~DELETED

~~1.4.1 Measured Clearing~~

~~Clearing will be measured by actual number of trees removed. Areas of light brush, shrubs, and other vegetation that can be cut with a brush hook, scythe, or mowing machine will not be measured as clearing.~~

~~1.4.2 Measured Grubbing~~

~~Grubbing will be measured by actual number of stumps and root mass. Areas where tree roots and timber are less than 75 millimeters (3 inches) in diameter and areas where roots of brush, shrubs, and other vegetation can be removed by plowing will not be measured as grubbing.~~

~~1.4.3 *Omitted*~~

~~1.4.4 Tree Removal~~

~~Tree removal will be measured by the number of trees of stated sizes removed from areas as shown on plans to be removed. The size will be~~

~~determined by the average diameter of the trunk 1 meter (4 feet) above the ground line. The size of stumps designated for removal as trees will be determined by the diameter of the trunk 1 meter (4 feet) above the ground line. The diameter will be measured to the nearest 25 millimeter (full inch).~~

*6 1.5 ~~PAYMENT~~DELETED

~~1.5.1 Clearing~~

~~Payment for clearing will be made at the lump sum contract price for clearing, and this price shall constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the work specified herein.~~

~~1.5.2 Grubbing~~

~~Payment for grubbing will be made at the lump sum contract price for grubbing, and this price shall constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the work specified herein.~~

~~1.5.3 *Omitted*~~

~~1.5.4 Tree Removal~~

~~Payment for tree removal will be made at the contract unit price for removing trees, or stumps designated as trees, that are shwon to be removed in accordance with the following schedule of sizes:~~

PART 2 *OMITTED*

PART 3 EXECUTION

3.1 CLEARING

Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 40 millimeters (1-1/2 inches) or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 40 millimeters (1-1/2 inches) in diameter shall be painted with an approved tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.

3.2 GRUBBING

Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 0.5 meters (18 inches) below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

## 3.3 TREE REMOVAL

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

## 3.4 DISPOSAL OF MATERIALS

Move all materials off site to an approved inert land fill located off Hunter AAF Base. At Contractor’s option, material may be salvaged and used by the Contractor.

### 3.4.1 *Omitted*

### 3.4.2 Materials Other Than Salable Timber

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations shall not be disposed of outside the limits of Government-controlled land at the Contractor's responsibility, except when otherwise approved in writing. Such permission will state the conditions covering the disposal of such products and will also state the areas in which they may be placed.

-- End of Section --

SECTION 02210

GRADING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556 (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))

ASTM D 2167 (1984; R 1990) Density and Unit Weight of Soil in Place by the Rubber Balloon Method

ASTM D 2487 (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

1.2 *OMITTED*

1.3 DEFINITIONS

1.3.1 Satisfactory Materials

*3 Materials classified in ASTM D 2487 as SM, SC, GM, GC, SP, CL, ML, GW, GP, and SW, and free from roots and other organic matter, trash, debris, and frozen materials and stones larger than 150 mm (6 inches) in any dimension are satisfactory.

1.3.2 Unsatisfactory Materials

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

1.3.3 Cohesionless and Cohesive Materials

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

1.3.4 Degree of Compaction

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

1.3.5 *Omitted*

1.3.6 Topsoil

Material obtained from excavations, suitable for topsoils, is defined as fertile, natural soil obtained from the top four, excavated inches after surface material has been stripped, generally obtained from lawn or planting areas. Excavted topsoil shall be without shall be without admixture of subsoil or slag and free of stones, lumps, sticks, plants or their roots, toxic substances or extraneous matter that maybe harmful to plant growth or would interfere with future maintenance. Topsoil pH range shall be 5.3 to 6.0. verified by soil test.

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-08 Statements

*3 Field Testing Control; GA ~~FIO~~.

Qualifications of the commercial testing laboratory who will be performing all testing in accordance with paragraph FIELD TESTING CONTROL.

SD-09 Reports

Field Testing Control; FIO. Satisfactory Materials; FIO.

Certified test reports and analysis certifying that the satisfactory materials proposed for use at the project site conform to the specified requirements, and for all tests conducted in accordance with paragraph FIELD TESTING CONTROL.

1.5 SUBSURFACE DATA

*3 Subsurface soil boring logs are shown on the civil plates of the plans. ~~appended to the SPECIAL CLAUSES~~. The subsoil investigation report and samples of materials taken from subsurface investigations may be examined at the Office of Contracting Building No. . These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

PART 2 PRODUCTS

2.1 OMITTED

2.2 BORROW MATERIAL

Borrow material shall be selected to meet requirements and conditions of the particular fill for which it is to be used. Necessary clearing, grubbing, disposal of debris, and satisfactory drainage of borrow pits shall be performed by the Contractor as incidental operations to the borrow excavation.

2.2.1 Selection

Borrow materials will be approved by Contracting Officer and will be obtained from sources off post.

PART 3 EXECUTION

3.1 CONSERVATION OF TOPSOIL

Where indicated, topsoil shall be removed to a depth of 101 millimeters (4 inches) without contamination with subsoil and stockpiled convenient to areas for later application or at locations specified. Topsoil shall be removed to full depth and shall be stored separate from other excavated materials and piled free of roots, stones, and other undesirable materials. Any surplus of topsoil from excavations and grading shall be removed from the site.

3.2 EXCAVATION

After topsoil removal has been completed, excavation of every description, regardless of material encountered, within the grading limits of the project shall be performed to the lines and grades indicated. Satisfactory excavation material shall be transported to and placed in fill areas within the limits of the work. All unsatisfactory material including any soil which is disturbed by the Contractor's operations or softened due to exposure to the elements and water and surplus material shall be removed from site and disposed of in areas approved for surplus material storage. In the event that it is necessary to remove unsatisfactory material to a depth greater than specified, the Contracting Officer shall be notified and an adjustment in the contract price will be considered in accordance with the contract. Unsatisfactory material excavated below the grade shown and replaced with satisfactory material as directed shall be included in the contract unit price for excavation. Excavations carried below the depths indicated, without specific directions, shall, except as otherwise specified, be refilled to the proper grade with satisfactory material as directed. All additional work of this nature shall be at the Contractor's expense. Excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Excavations shall be kept free from water while construction therein is in progress. Material required for fills in excess of that produced by excavation within the grading limits shall be obtained from borrow areas.
*12
Excavated soils shall be screened at the time of excavation and separated into “uncontaminated” and “contaminated” stockpiles. Field screening shall consist of real-time organic vapor monitoring using a PID to obtain a vapor reading from every third backhoe or excavator bucket of excavated material. Organic vapors shall be measured 2 to 3 inches above the soil in the bucket of the excavation equipment as soon as it is excavated. Excavated material that has an obvious petroleum odor, visual petroleum staining, or a PID response of greater than 10 PID units shall be considered contaminated and stockpiled for analytical testing. Uncontaminated soil shall be stockpiled separately from the contaminated soil, a safe distance away from but adjacent to, the excavation. Uncontaminated soils, if suitable, shall be used as backfill. If soil screening results in readings above the 10 PID unit threshold, the contractor shall implement SECTION 01110 of this specification.

Excavated soils screened as contaminated shall be stockpiled onsite in quantities of no more than 250 cubic meters per stockpile. Contaminated soils shall be placed onto an impermeable geomembrane groundcover having a minimal thickness of 6 mils, and subsequently covered from atmospheric exposure using a 6-mil polyethylene cover. These geomembranes shall be placed to prevent the stockpiled soils from coming into contact with rain or surface water run-off and to limit the escape of volatile organic compounds from the soil.

Material stockpiled as contaminated shall be sampled and analyzed as per the approved Sampling and Analysis Plan. At a minimum, one sample shall be collected for every 250 cubic meters of material stockpiled as contaminated. Samples shall be collected from the interior of the stockpiles on the same day the stockpile was started. Samples should be analyzed by EPA method 8260, Volatile Organic Compounds. Stockpiles shall be managed in such a way to ensure correct correlation with laboratory results. All contaminants above laboratory detection limits should be compared against the risk based Type I media criteria as per Georgia Hazardous Site Response Regulations (HSRA). For

samples exceeding these standards, the corresponding stockpile shall be considered contaminated and must be treated or disposed of as allowed by Georgia Regulations. For samples testing below these values, the corresponding stockpile shall be considered uncontaminated and shall, if suitable, be used as fill material.

## 3.3 DITCHES, GUTTERS, AND CHANNEL CHANGES

Ditches, gutters, and channel changes shall be cut accurately to the cross sections and grades indicated. All roots, stumps, rock, and foreign matter in the sides and bottom of ditches, gutters, and channel changes shall be trimmed and dressed or removed to conform to the slope, grade, and shape of the section indicated. Care shall be taken not to excavate ditches and gutters below the grades indicated. Excessive ditch and gutter excavation shall be backfilled to grade either with satisfactory, thoroughly compacted material or with suitable stone or cobble to form an adequate gutter paving as directed. All ditches and gutters excavated under this section shall be maintained until final acceptance of the work. Satisfactory material excavated from ditches and channel changes shall be placed in fill areas. Unsatisfactory and excess excavated material shall be disposed of in accordance with directions in paragraph EXCAVATION. No excavated material shall be deposited closer to the edges of the ditches than indicated and in no case less than 1 m (3 feet).

## 3.4 BACKFILL ADJACENT TO STRUCTURES

Backfill adjacent to structures shall be placed and compacted uniformly in such manner as to prevent wedging action or eccentric loading upon or against the structures. Slopes bounding or within areas to be backfilled shall be stepped or serrated to prevent sliding of the fill. During backfilling operations and in the formation of embankments, equipment that will overload the structure in passing over and compacting these fills shall not be used. Backfill for storm drains and subdrains, including the bedding and backfill for structures other than culverts and drains, shall conform to the additional requirements in other applicable sections.

## 3.5 PREPARATION OF GROUND SURFACE FOR FILL

All vegetation, such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish, and other unsatisfactory material within the area upon which fill is to be placed, shall be stripped or otherwise removed before the fill is started. In no case will unsatisfactory material remain in or under the fill area. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped, or broken up, as directed, in such manner that the fill material will bond with the existing surface. Prepared surfaces on which compacted fill is to be placed shall be wetted or dried as may be required to obtain the specified moisture content and density.

## 3.6 FILLS AND EMBANKMENTS

Fills and embankments shall be constructed at the locations and to lines and grades indicated. The completed fill shall conform to the shape of the typical sections indicated or shall meet the requirements of the particular case. Satisfactory material obtained during excavation may be used in forming required fill. Fill shall be satisfactory material and shall be reasonably free from roots, other organic material, and trash and from stones having a maximum diameter greater than 150 mm (6 inches). No frozen material will be permitted in the fill. Stones having a dimension greater than 100 mm (4 inches) shall not be permitted in the upper 150 mm (6 inches) of fill or embankment. The material shall be placed in successive horizontal layers of

200 mm and 300 mm in loose depth for the full width of the cross section and shall be compacted as specified. Each layer shall be compacted before the overlaying lift is placed. Moisture content of the fill or backfill material shall be adjusted by wetting or aerating, as required, to within plus or minus 100 mm percent of optimum moisture content as determined from laboratory tests specified in paragraph DEFINITIONS.

3.7 COMPACTION

Except for paved areas, each layer of the fill or embankment shall be compacted to at least 95% percent of laboratory maximum density. Areas to be paved and other areas indicated as requiring compaction suitable for paved areas shall be compacted to at least the percentage of laboratory maximum density shown for specific ranges of depth below the surface of the pavement. Areas to be paved and other areas indicated as requiring compaction suitable for paved areas shall be compacted to at least the percentage of laboratory
*3 maximum density shown in Section 02221, para. 3.13.4. ~~in the following tabulation for specific ranges of depth below the surface of the pavement:~~

~~Percentage of Laboratory Maximum Density Required~~

| ~~Depth Below Pavement Surface~~ | ~~Fill Fill Cohesive Materials~~ | ~~Cut Cohesionless Cohesionless Materials~~ | ~~Cut Cohesionless Materials~~ | ~~Cut Cohesive Materials~~ |
|---|---|---|---|---|
| ~~From:~~ | ~~surface~~ | ~~surface~~ | ~~surface~~ | ~~surface~~ |
| ~~To:~~ | ~~50 mm (24 in.)~~ | ~~50 mm (24 in.)~~ | ~~50 mm (24 in.)~~ | |
| | ~~50 mm (24 in.)~~ | | | |

3.8 FINISHED EXCAVATION, FILLS, AND EMBANKMENTS

All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified. Ditches and gutters shall be finished to permit adequate drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials. For subgrade areas to be paved, the following shall be accomplished as required: (a) soft or otherwise unsatisfactory material shall be replaced with satisfactory excavated material or other approved materials; (b) rock encountered in the cut sections shall be excavated to a depth of 150 mm (6 inches) below finished grade for the subgrade; (c) low areas resulting from removal of unsatisfactory material or from excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and shall be compacted as specified. The surface of embankments or excavated areas for road construction or other areas on which a base course or pavement is to be placed shall vary not more than 15 mm (0.05 foot) from the established grade and approved cross section. Surfaces other than those that are to be paved shall be finished not more than 45 mm (0.15 foot) above or below the established grade or approved cross section.

3.9 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 50 mm (2 inch) depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness of 102 mm (4 inches) and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or

excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained fromoff-site areas.

## 3.10 FIELD TESTING CONTROL

*3 Testing shall be the responsibility of the Contractor and shall be performed by an approved commercial testing laboratory. ~~or by the Contractor subject to approval~~. Field density and moisture content tests shall be performed on every ~~76~~ 300 square meters (~~250~~ 1000 square feet) of each millimeter (6-inch) lift placed. Field in-place density shall be determined in accordance with ASTM D 1556. ~~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. 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.~~ Moisture content shall be determined in accordance with ASTM D 2216. Test required on materials prior to placement and testing procedures to control compaction and to relocate field density date to laboratory test values shall be as specified in section 2221A, EXCAVATION FILLING AND BACKFILLING FOR BUILDINGS.

## 3.11 PROTECTION

Newly graded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. All work shall be conducted in accordance with the environmental protection requirements of the contract.

-- End of Section --

SECTION 02221A

# EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

## PART 1 GENERAL

### 1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM C 136 | (1984a) Sieve Analysis of Fine and Coarse 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-lbf/cu. ft.) |
| ASTM D 2216 | (1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock |
| ASTM D 2487 | (1992) Classification of Soils for Engineering Purposes (Unified Soil Classification System) |
| ASTM D 4318 | (1984) 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.

#### 1.2.2 Maximum Dry Density

The maximum dry density is expressed as the maximum density obtained when the soil is compacted in accordance with ASTM D 1557, abbreviated hereinafter as laboratory maximum dry density.

#### 1.2.3 Optimum Moisture Content

The optimum moisture content is the moisture content corresponding to the maximum dry density obtained by the test procedure presented in ASTM D 1557.

#### 1.2.4 Soil Boring Logs

*3 Logs of soil test borings are included in in the Civil plates of the plans. ~~Appendix A of Attachment 1 to Section 00800 of these specifications.~~ Graphic symbols, letter symbols and soil descriptions, in accordance with the Unified Soil Classification System indicate field identification of the soils encountered. While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and, if encountered, such variations will not be considered as differing materially within the purview of the DIFFERING SITE CONDITIONS clause of the contract. Also refer to clause PHYSICAL DATA of Section 00800 of these specifications.

1.2.5 Related Work

1.2.5.1 Protection of existing vegetation, structures, utilities, work, and improvements is specified in the CONTRACT CLAUSES.

1.2.5.2 Site grading and excavation and backfilling for utilities beyond the 5-foot building line are covered under other specifications sections entitled GRADING and EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS.

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

Testing Facilities; GA.

Testing facilities for the performance of laboratory soil tests must be inspected and approved by the Contracting Officer prior to work being performed.

SD-09 Reports

Test Reports; FIO.

Copies of all test reports, including analysis and interpretation of test results specified herein shall be submitted within 24 hours after completion of the test. Each report shall be properly identified. Test methods used and compliance with specified test standards shall be described. Summary sheets specified herein shall be submitted as indicated.

Inspection, Equipment and Corrective Action Reports; FIO.

Copies of inspection reports, equipment specifications, and records of corrective actions taken shall be submitted.

SD-13, Certificates

Certificates of Compliance; FIO.

Certificates of compliance indicating conformance with specified requirements shall be furnished for capillary water barrier materials.

PART 2 PRODUCTS

## 2.1 MATERIALS

### 2.1.1 Satisfactory Materials

#### 2.1.1.1 Natural Insitu Soil

Satisfactory materials for natural insitu soil supporting building foundations and/or slabs shall be limited to materials classified in ASTM D 2487 as GW, GP, SW, GM, GC, SP, SM, SC, CL, CH, ML and MH and shall be free of trash,
*5 debris, roots or other organic matter, or stones larger than 75 mm (3 inches) in any dimension.

#### 2.1.1.2 Foundation Fill or Backfill

Satisfactory materials for fill or backfill supporting building foundations and/or slabs shall be limited to materials classified in ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, CL, and ML.

#### 2.1.1.3 Fill or Backfill Adjacent to Walls

Satisfactory materials for fill or backfill adjacent to walls shall be limited to cohesionless free-draining materials classified in ASTM D 2487 as GW, GP, GM, SW, SP, and SM.

### 2.1.2 Unsatisfactory Materials

#### 2.1.2.1 Natural Insitu Soil

Unsatisfactory materials for natural insitu soil supporting building foundations and/or slabs shall be materials classified in ASTM D 2487 as Pt, OH, and OL, and any other materials not defined as satisfactory.

#### 2.1.2.2 Foundation Fill or Backfill

Unsatisfactory materials for fill or backfill supporting building foundations and/or slabs shall be materials classified in ASTM D 2487 as Pt, OH, OL, CH, and MH.

#### 2.1.2.3 Fill or Backfill Adjacent to Walls

Unsatisfactory materials for fill or backfill adjacent to walls shall be materials classified in ASTM D 2487 as Pt, OH, OL, GC, SC, CL, CH, ML, and MH.

#### 2.1.2.4 Wet or Soft Materials

Materials determined by the Contracting Officer as too wet or too soft to provide a stable subgrade, foundation, or fill will be classified as unsatisfactory regardless of classification. However, if such materials do meet the appropriate ASTM D 2487 classification and it is possible to condition them to provide a stable subgrade, foundation, or fill, the Contractor shall at no additional cost to the Government, recondition the materials.

### 2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include poorly and well graded gravels (GP and GW) and poorly and well graded sands (SP and SW). Cohesionless soils are generally regarded as free draining. Cohesive materials include clayey gravels (GC), clayey sands (SC), and lean clays (CL), fat clays (CH), silts (ML and MH) and organic materials (Pt, OL, and OH). Materials such as gravel-silt mixtures (GM) and silty sands (SM) will be considered cohesionless only when the fines

have a plasticity index of zero; otherwise they will be considered cohesive. Very silty soils may exhibit narrow ranges of moisture content within which optimum compaction can be obtained.

2.2 CAPILLARY WATER BARRIER

Capillary water barrier shall consist of clean, crushed, nonporous rock,
*5 crushed gravel, or uncrushed gravel. The maximum particle size shall be 40 mm (1-1/2 inches) and no more than 2 percent by weight shall pass the No. 4 size sieve.

PART 3 EXECUTION

3.1 CLEARING AND GRUBBING

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

3.2 TOPSOIL

*5 Topsoil shall be stripped to a depth of 150 mm (6 inches) below existing grade within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified hereinafter, and shall
*5 include trenching for utility and foundation drainage systems to a point 1500 mm (5 feet) beyond the building line of each building and structure, and all work incidental thereto. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed and replaced with satisfactory material. Payment therefor will be made in conformance with the CHANGES clause of the CONTRACT CLAUSES. Satisfactory material removed below the depths indicated without specific direction of the Contracting Officer shall be replaced at no additional cost to the Government to the indicated excavation grade with satisfactory materials, except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraphs SUBGRADE PREPARATION and 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.
*12
Excavated soils shall be screened at the time of excavation and separated into “uncontaminated” and “contaminated” stockpiles. Field screening shall consist of real-time organic vapor monitoring using a PID to obtain a vapor reading from every third backhoe or excavator bucket of excavated material. Organic vapors shall be measured 2 to 3 inches above the soil in the bucket of the excavation equipment as soon as it is excavated. Excavated material that has an obvious petroleum odor, visual petroleum staining, or a PID response of greater than 10 PID units shall be considered contaminated and stockpiled for analytical testing. Uncontaminated soil shall be stockpiled separately from the contaminated soil, a safe distance away from but adjacent to, the excavation. Uncontaminated soils, if suitable, shall be used as backfill. If soil screening results in readings above the 10 PID unit threshold, the contractor shall implement SECTION 01110 of this specification.

Excavated soils screened as contaminated shall be stockpiled onsite in quantities of no more than 250 cubic meters per stockpile. Contaminated soils shall be placed onto an impermeable geomembrane groundcover having a minimal thickness of 6 mils, and subsequently covered from atmospheric exposure using a 6-mil polyethylene cover. These geomembranes shall be placed to prevent the stockpiled soils from coming into contact with rain or surface water run-off and to limit the escape of volatile organic compounds from the soil.

Material stockpiled as contaminated shall be sampled and analyzed as per the approved Sampling and Analysis Plan. At a minimum, one sample shall be collected for every 250 cubic meters of material stockpiled as contaminated. Samples shall be collected from the interior of the stockpiles on the same day the stockpile was started. Samples should be analyzed by EPA method 8260, Volatile Organic Compounds. Stockpiles shall be managed in such a way to ensure correct correlation with laboratory results. All contaminants above laboratory detection limits should be compared against the risk based Type I media criteria as per Georgia Hazardous Site Response Regulations (HSRA). For samples exceeding these standards, the corresponding stockpile shall be considered contaminated and must be treated or disposed of as allowed by Georgia Regulations. For samples testing below these values, the corresponding stockpile shall be considered uncontaminated and shall, if suitable, be used as fill material.

## 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
*12 site shall be continually and effectively drained. ~~Excavation shall not be deeper than one meter above groundwater due to the possibility of groundwater contamination.~~

### 3.4.2 Dewatering

Any water 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. Dewatering shall be accomplished to the extent that no rutting or pumping occurs under the action or operation of construction equipment.
*5 French drains, sumps, ditches or trenches will not be permitted within 900 mm (3 feet) of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the
*12 the in situ material. ~~While the excavation is open, the water level shall be maintained continuously, at least 900 mm (3 feet) below the working level.~~

3.4.3 Control of Ground Water

Where ground water is encountered, dewatering by the use of well points or other approved methods will be required to the extent that excavation for all foundations and utilities is performed in the dry. If after dewatering, localized wet soft areas remain, the areas shall be dried by aerating or other satisfactory means; or at the Contractor's option and at no additional cost to
*5 the Government, localized soft areas may be undercut a minimum of 600 mm (2 feet) and replaced with compacted free-draining materials such as GW, GP, SW, SP in order to provide a stable working surface. Dewatering of foundation excavations will be maintained until concrete is placed, cured, and the excavation is backfilled. Dewatering of utility excavations will be maintained until pipe and conduit are placed and tested and the trench backfilled. Backfilling with satisfactory materials and compaction shall be as specified in paragraphs SUBGRADE PREPARATION and FILLING AND BACKFILLING.
*12 ~~Discharge from the dewatering system shall be carried to any convenient approved location.~~ If any dewatering of the excavation is required, the water being removed shall be considered contaminated with Trichloroethylene (TCE) and Tetrachloroethylene (PCE) and shall be pumped through piping to a storage tank. The tank shall be of a design and materials suitable for the storage of contaminated water. The minimum volume of the tank shall be 20,000 gallons. Samples of water pumped from any excavation shall be collected daily and analyzed as per the approved Sampling and Analysis Plan. In addition, one sample representative of the total volume of the tank shall be collected and analyzed for determining the proper disposal method. Chemical analyses of contaminated water shall conform to the requirements of the Hunter Army Airfield treatment works with documentation of all analyses performed furnished to the Contracting Officer. If test results indicate the contamination is below acceptable discharge levels required for the Hunter Army Airfield treatment works, the water shall be disposed of into the sewage manhole closest to the construction site at a rate acceptable to the treatment works. If it is determined that the water in the storage tank is contaminated at levels exceeding the limits of the Hunter Army Airfield treatment works, it shall be the responsibility of the Army to properly dispose of the water. In no case shall any water pumped from any excavation be returned to the ground water or discharged to local drainage features or surface waters.

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. Separate trenches shall be excavated for sewer, water, and gas pipes, and

underground electrical, communication and signal services unless otherwise indicated. Care shall be exercised to minimize disturbance to the capillary water barrier or compacted subgrade.

3.9 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained from borrow pits off post. No government borrow is available..

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 outside the limits of Government-controlled land and at the Contractor's responsibility. No satisfactory material shall be wasted or used for the convenience of the Contractor unless so authorized. Stockpiles and wasted materials shall be placed, graded, and shaped for proper drainage, giving due consideration to drainage from adjacent properties.

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.

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
*5 be scarified to a depth of 150 mm (6 inches) before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 150 mm (6 inches), pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 300 mm (12 inches) and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to plus or minus 2.5 percent of optimum moisture. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

## 3.13 FILLING AND BACKFILLING

### 3.13.1 General

Backfilling shall not begin until construction below finished grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation is cleaned of trash and debris. No fill or backfill material shall be placed on areas that are wet, muddy, frozen, contain frost, organic materials or are otherwise unacceptable to the Contracting Officer. Satisfactory materials shall be used in bringing fills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory material shall be free from roots and other organic matter,
*5 trash, debris, frozen materials, and stones larger than 75 mm (3 inches) in any dimension. Where pipe and or utility lines are coated or wrapped for protection against corrosion, the backfill material up to an elevation 600 mm (2 feet) above sewer lines and 300 mm (1 foot) above other utility lines shall be free from stones larger than 25 mm (1 inch) in any dimension.

### 3.13.2 Placement

*5 Satisfactory materials shall be placed in horizontal layers not exceeding 200 mm (8 inches) in loose thickness, or 100 mm (4 inches) in loose thickness where hand-operated compactors are used. After placing, each layer shall be plowed, disced, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfill shall be brought to indicated finished grade. 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 (4 inches) in compacted thickness with power driven hand tampers having a minimum static weight of 113 kg (250 pounds) and 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 practical, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Prior to compaction, each layer shall be thoroughly and uniformly blended throughout its entire thickness by discing.

### 3.13.3 Moisture Content

Satisfactory materials in each layer of fill shall contain the amount of moisture within the limits specified below. Materials that are not within the specified limits after compaction shall be reworked regardless of density. The moisture content after compaction shall be as uniform as practicable throughout any one layer and shall be within the limits of 2.5 percentage points above optimum moisture content and 2.5 percentage points below optimum moisture content. Materials which are too wet shall be disced, harrowed, plowed, bladed, or otherwise manipulated to reduce the moisture content to within the specified limits. Materials which are too dry shall be broken up, sprinkled, and thoroughly mixed to bring the moisture content uniformly up to within specified limits. In the event that materials reach the fill which are not within the limits of moisture content specified above, the Contractor shall either adjust the moisture content to bring it within the specified limits or remove it from the fill.

### 3.13.4 Compaction

Compaction shall be accomplished by sheepsfoot roller, pneumatic-tired rollers, smooth-drum vibratory rollers or other approved equipment well suited to the soil being compacted. Generally, sheepsfoot rollers are best suited for compacting cohesive material while smooth-drum vibratory rollers are best

suited for compacting cohesionless materials. In areas inaccessible to heavy equipment, or where in the opinion of the Contracting Officer, use of heavy equipment may cause damage to pipes, conduits, or structures, approved power-driven hand tampers suitable for the material being compacted shall be used. Each layer shall be compacted to not less than the percentage of maximum dry density specified below:

| | Percent Laboratory Maximum Dry Density |
|---|---|
| **Fill, Embankment, and Backfill** | |
| Under structures, building slabs, steps, paved areas, around footings, and in trenches | 95 |
| Under sidewalks and grassed areas | 85 |
| **Subgrade** | |
| *5 Under building slabs, and steps, top 300 mm (12 inches) | 95 |
| Under paved areas, top 300 mm (12 inches) | 98 |
| Under sidewalks, top 150 mm (6 inches) | 85 |

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. For compacted subgrades and/or any lift of fill or backfill that fails to meet the specified density requirement, the entire subgrade and/or entire lift of fill *5 shall be broken up to a minimum depth of 225 mm (9 inches), pulverized, and recompacted to the specified density, even if this action requires the removal and replacement of previously placed satisfactory lifts of fill. Lifts of fill placed without being field density tested will not be accepted as satisfactory under any circumstances.

## 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 accomplished in this type of work. Frequency of tests shall be as specified hereinafter. Copies of test results shall be promptly furnished to the Contracting Officer.

### 3.14.1 Types of Tests

#### 3.14.1.1 Classification Tests

Classification of soils shall be determined in accordance with ASTM D 2487.

##### 3.14.1.1.1 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM

D 4318.

3.14.1.1.2 Sieve Analysis

Sieve analyses shall be made as specified in ASTM C 136 or ASTM D 422.

3.14.1.2 Moisture Content

Moisture content shall be determined in accordance with ASTM D 2216.

3.14.1.3 Compaction Tests

Compaction tests shall be performed by the test procedure presented in ASTM D 1557. Adequate testing shall be conducted to establish at least five points with at least one point falling within plus or minus 1.5 percentage points of the plotted optimum moisture content.

3.14.1.4 Field Density Tests

Field in-place densities shall be determined by the sand displacement method in accordance with ASTM D 1556. The Contracting Officer reserves the right to direct the locations where field density tests are to be performed. Daily density tests shall be recorded on CESAS Form 1177 - Summary of Field Density Tests and an updated copy furnished to the Contracting Officer weekly. Government forms will be furnished to the Contractor by the Contracting Officer.

3.14.2 Tests Required on Materials Prior to Placement

3.14.2.1 General

All materials from required excavations and borrow shall be tested prior to incorporation into the permanent work. The tests shall be representative of the various materials to be utilized. Samples shall be carefully selected to represent the full range of materials to be used as fill and/or backfill. The following minimum number of tests shall be performed on the materials prior to the placement of the material in the work. Additional tests of these types shall be performed when materials of different classification or compaction characteristics are encountered to determine the properties of the materials tested. The Contracting Officer reserves the right to direct additional testing as required.

3.14.2.2 Classification Tests

Classification tests shall be performed to determine the acceptability of materials in accordance with paragraph Satisfactory Materials. Such tests on materials proposed for use as fill and/or backfill shall be performed prior to their use. Sufficient classification tests shall be performed to define the full range of all materials proposed for use. A minimum of two classification tests shall be performed on each material classified as satisfactory for use. The Contracting Officer may at any time require additional classification tests to confirm material acceptability.

3.14.2.3 Compaction Tests

Compaction tests shall be performed prior to commencement of construction in order to determine the moisture-density relationships of all satisfactory materials proposed for use as fill and/or backfill. For each compaction test performed, an associated or companion classification test and moisture content test shall be performed. Compaction tests shall be performed in sufficient number to establish the full range of maximum dry density and optimum water

content. A minimum of seven compaction tests shall be performed on material classified as satisfactory for use. Samples for these tests shall not be obtained from the same locations. The Contracting Officer reserves the right to direct where samples for additional compaction tests are obtained. In the event that the compaction characteristics of materials having the same classification vary appreciably, additional compaction tests will be required.

3.14.2.4 Moisture Content Tests

Moisture content tests shall be performed on all materials proposed for use as fill and/or backfill to determine their suitability for use in accordance with paragraph Moisture Content. Moisture content tests shall be performed in sufficient number to determine the full range of moisture contents. Moisture content test shall be performed for each compaction test and as required to determine acceptability of material prior to placement. Not less than two moisture content tests shall be performed on each material classified as satisfactory for use.

3.14.3 Frequency of Testing During Construction

3.14.3.1 Minimum Number of Tests

The minimum number of tests required during placement and compaction of fill and/or backfill, for each lift per building or structure, shall be as specified in the following:

| Square feet in Lift to be Compacted | Minimum Tests Required Per Lift<br>Field Density and Moisture Content |
|---|---|
| Up to 4,000 | 1 |
| 4,001 to 15,000 | 2 |
| 15,001 to 50,000 | 3 |
| Each additional 15,000 SF or portion thereof, but not to exceed more than 10 tests per lift | 1 |

3.14.3.2 Other Testing

In addition to the above, where other areas or subareas are compacted separately, such as areas enclosed by interior grade beams, areas of long narrow fills, and/or areas compacted by hand operated compaction equipment, a
*5 minimum of one field density test shall be performed for every 46 square meters (500 square feet) of fill placed per foot of depth.

3.14.3.3 Time and Location of Tests

The Government reserves the right to designate the location of any test. Whenever there is doubt as to the adequacy of the testing or validity of results, the Contracting Officer may direct that additional tests be performed, at no additional cost to the Government. The field density tests shall be performed at times and locations which will assure the specified compaction is being obtained throughout each lift for all materials placed. Field density tests shall also be performed in areas where the Contracting Officer determines there is reason to doubt the adequacy of the natural

subgrade.

3.14.3.4 Field Density Control

The results of field density tests shall be compared to results of compaction tests performed as required elsewhere in these specifications by the use of the appropriate procedure described in paragraph Compaction Control. The above described comparison of test results shall be made in order to determine the percent compaction of the sample. For calculating field densities and percent compaction, SAS Form 865 dated 04 Aug 78 shall be used and shall be submitted with density results.

3.14.4 Compaction Control

3.14.4.1 General

For fine grained (clayey and silty) soils and for sands with appreciable fines such that normal shaped compaction curves are obtained, results of all compaction tests shall be plotted on a common plot as a family of curves. For each field density test performed, a one-point compaction test, with additional points as needed, shall be performed on the same material on which the field density test was conducted. The one-point compaction test shall be performed on the dry side of the optimum moisture content. For comparison of field density data, to the proper laboratory compaction test results, the procedures for the one-point and/or two-point compaction control methods as described in paragraph Compaction Procedure, shall be used. Compaction curves plotted on the family of curves shall be of such a scale that the optimum moisture content can be interpreted to the nearest 1/10 percent and the
*5 maximum dry density can be interpreted to the nearest 45 grams (1/10 pound). When a one-point test plots outside the range of the family of curves, an additional five-point compaction test shall be performed.

3.14.5 Compaction Procedure

3.14.5.1 General

The following paragraphs describe methods of relating field density data to desired or specified values. Compaction control of soils requires comparison of fill water content and/or dry density values obtained in field density tests with optimum water content and/or maximum dry density. For fine grained soils or sandy materials with appreciable fines, field results are to be compared with results of laboratory compaction tests performed in accordance with procedures specified elsewhere in this specification section. Insofar as possible, control shall be in accordance with the One-Point Compaction Method. Where conditions require, the Two-Point Compaction Method shall be used.

3.14.5.2 One-Point Compaction Method

The material from the field density tests is allowed to dry to a water content on the dry side of estimated optimum, and then compacted using the same equipment and procedure used in the five-point compaction test. Thorough mixing is required to obtain uniform drying; otherwise, results obtained may be erroneous. The water content and dry density of the compacted sample are determined and then used to estimate its optimum water content and maximum dry density as illustrated in Figure 1 at the end of this section. In Figure 1, the line of optimums is well defined and the compaction curves are approximately parallel to each other, consequently, the one-point compaction method could be used with a relatively high degree of confidence. However, in Figure 2 at the end of this section, the optimums do not define a line, but a broad band. Also, the compaction curves are not parallel to each other and in several instances will cross if extended on the dry side. Consequently, the

correct curve cannot be determined from the one-point method; therefore, the two-point compaction method should be used. The one-point method should be used only when the data define a relatively good line of optimums.

3.14.5.3 Two-Point Compaction Method

In the two-point test, one sample of material from the location of the field density test is compacted at the fill water content if thought to be at or on the dry side of optimum water content (otherwise, reduced by drying to this condition) using the same equipment and procedures used in the five-point compaction test. A second sample of material is allowed to dry back about 2 to 3 percentage points dry of the water content of the first sample and then compacted in the same manner. At least one point shall fall within 3 percent of the line of optimums. After compaction, the water contents and dry densities of the two samples are determined. The results are used to identify the appropriate compaction curve for the material being tested as shown in Figure 2 at the end of this section. The data shown in Figure 2 warrant the use of the two-point compaction test because the five-point compaction curves are not parallel. Using point A only, as in the one-point test method, would result in appreciable error as the shape of the curve would not be defined. The estimated compaction curve can be more accurately defined by two compaction points.

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 having a minimum
*5 static weight of 113 kg (250 pounds).

3.16 GRADING

Areas within 1.5 m (5 feet) outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

3.17 SPREADING TOPSOIL

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
*5 or maintenance operations. The subgrade shall be pulverized to a depth of 50 mm (2 inches) by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown or specified, 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 (100 to 160 pounds per linear foot) of roller. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

3.18 PROTECTION

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

3.19 QUALITY CONTROL

3.19.1 General

During construction an established system of control shall be maintained, to assure compliance with contract requirements and the maintenance of records of all materials, equipment, and construction operations. Control shall include, but not be limited to the following:

3.19.1.1 Suitability of Material

Required soil tests to confirm the suitability of material proposed for use as fill or backfill including classification, moisture and compaction data.

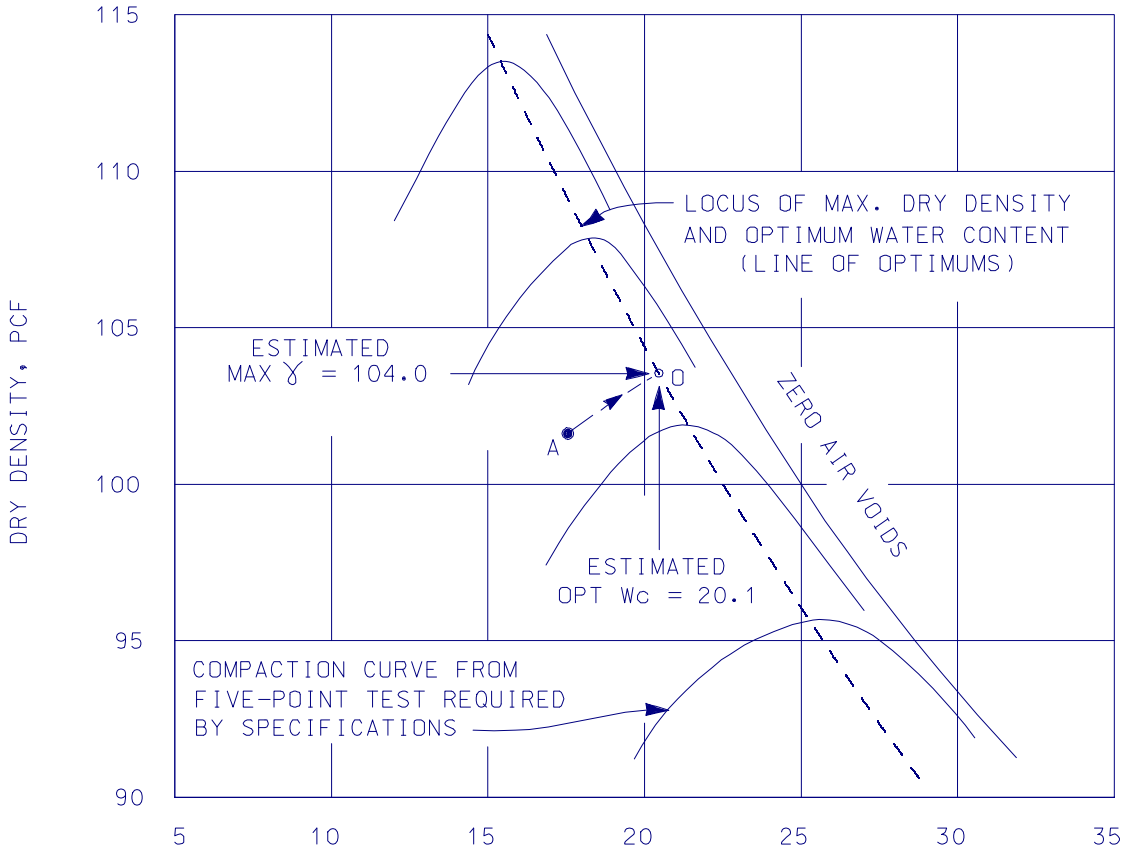
3.19.1.2 Frequency of Testing

Soil tests in accordance with the required testing frequency of compacted subgrade and fill and to confirm the suitability of material placed in the completed work including field density, moisture content, compaction and classification tests.

3.19.1.3 Records

A copy of all records and test data specified herein and the records of corrective action taken shall be furnished the Contracting Officer within the time frame specified.

*5 ***End of Section***



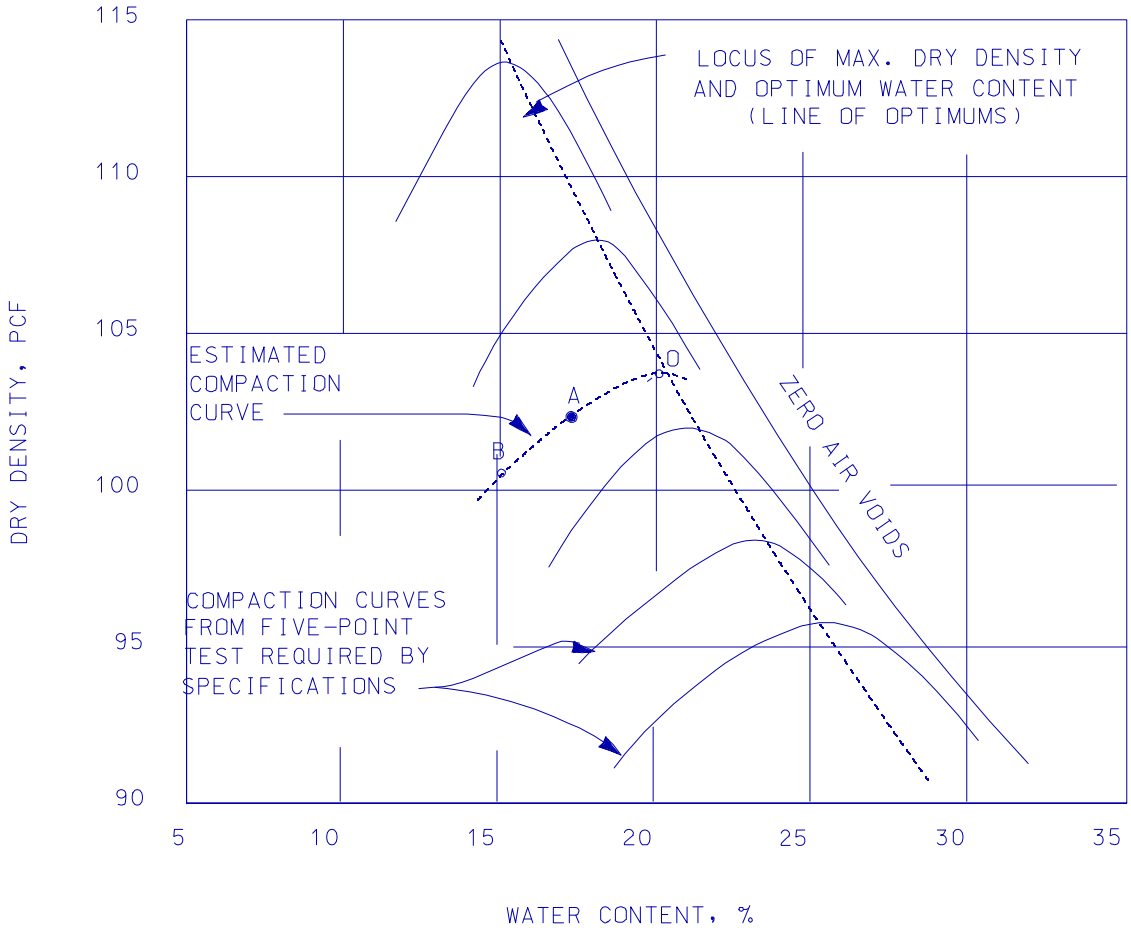

PROCEDURE:

1. Point A is the result of a one-point test on material from field density test. This point must be on the dry side of optimum water content.

2. Point O gives the estimated OPT Wc and Max density of the fill material based on a projection of point A approximately parallel to the adjacent compaction curves.

3. Point A must plot within 3 percent of the line of optimums.

**Figure 1. Illustration of one-point compaction method.**




PROCEDURE:

1. Points A and B are results of a two-point compaction test on material from field density test. Points A and B must be on the dry side of optimum water content.

2. The estimated compaction curve based on Points A and B establishes Point O on the locus, which is the estimated maximum dry density and optimum water content of the fill material.

3. One point must plot within 3 percent of the line of optimums.

**Figure 2. Illustration of two-point compaction method.**

*** END ***

SECTION 02222A

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

PART 1 GENERAL

1.1 SUMMARY (Not Applicable)

1.2 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM 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-lbf/ft$^3$ (2,700 kN-m/m$^3$)) |
| ASTM D 2487 | (1990) Classification of Soils for Engineering Purposes |

1.4 DEFINITIONS

1.4.1 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

1.5 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 DESCRIPTIONS:

SD-09 Reports

Field Density Tests; FIO. Testing of Backfill Materials; FIO.

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

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

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

2.1.2 Unsatisfactory Materials

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

2.1.3 Cohesionless and Cohesive Materials

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

2.1.4 *Omitted*
2.1.5 *Omitted*
2.1.6 *Omitted*

2.1.7 Select Granular Material

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

2.1.8 Initial Backfill Material

Initial backfill shall consist of select granular material or satisfactory materials free from rocks 3 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, the initial backfill material shall be free of stones larger than 1 inch in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

2.1.9 Plastic Marking Tape

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1,750 psi lengthwise and 1,500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

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

PART 3 EXECUTION

3.1 EXCAVATION

Excavation of every description, regardless of material encountered, shall be performed to the lines and grades indicted. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.
*12
Excavated soils shall be screened at the time of excavation and separated into “uncontaminated” and “contaminated” stockpiles. Field screening shall consist of real-time organic vapor monitoring using a PID to obtain a vapor reading from every third backhoe or excavator bucket of excavated material. Organic vapors shall be measured 2 to 3 inches above the soil in the bucket of the excavation equipment as soon as it is excavated. Excavated material that has an obvious petroleum odor, visual petroleum staining, or a PID response of greater than 10 PID units shall be considered contaminated and stockpiled for analytical testing. Uncontaminated soil shall be stockpiled separately from the contaminated soil, a safe distance away from but adjacent to, the excavation. Uncontaminated soils, if suitable, shall be used as backfill. If soil screening results in readings above the 10 PID unit threshold, the contractor shall implement SECTION 01110 of this specification.

Excavated soils screened as contaminated shall be stockpiled onsite in quantities of no more than 250 cubic meters per stockpile. Contaminated soils shall be placed onto an impermeable geomembrane groundcover having a minimal thickness of 6 mils, and subsequently covered from atmospheric exposure using a 6-mil polyethylene cover. These geomembranes shall be placed to prevent the stockpiled soils from coming into contact with rain or surface water run-off and to limit the escape of volatile organic compounds from the soil.

Material stockpiled as contaminated shall be sampled and analyzed as per the approved Sampling and Analysis Plan. At a minimum, one sample shall be collected for every 250 cubic meters of material stockpiled as contaminated. Samples shall be collected from the interior of the stockpiles on the same day the stockpile was started. Samples should be analyzed by EPA method 8260, Volatile Organic Compounds. Stockpiles shall be managed in such a way to ensure correct correlation with laboratory results. All contaminants above laboratory detection limits should be compared against the risk based Type I media criteria as per Georgia Hazardous Site Response Regulations (HSRA). For samples exceeding these standards, the corresponding stockpile shall be considered contaminated and must be treated or disposed of as allowed by Georgia Regulations. For samples testing below these values, the corresponding stockpile shall be considered uncontaminated and shall, if suitable, be used as fill material.

3.1.1 Trench Excavation

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls below the top of the pipe shall be made vertical, and trench walls above the top of the pipe shall be sloped as required to properly

complete the work. Trench walls more than 4 feet high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 4 feet high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter and shall not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

3.1.1.1 Bottom Preparation

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

3.1.1.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, such material shall be removed 6 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.1.1.3 Removal of Unstable Material

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

3.1.1.4 Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.1.1.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.1.1.6 Stockpiles

Stockpiles of satisfactory and unsatisfactory materials shall be placed and

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

3.1.1.7 Cutting and Removing of Existing Pavement

Existing pavement cut for the removal of, or in the installation of, utility lines shall be removed to neat lines and disposed of as directed. Where it is necessary to remove pavement at a point other than a joint, the pavement shall be removed by cutting on a straight and true line. Concrete pavement shall be cut with an approved concrete saw to a depth of at least 2 inches and the remaining depth may be sheared or broken with suitable pneumatic tools.

3.2 BACKFILLING AND COMPACTION

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

3.2.1 Trench Backfill

Trenches shall be backfilled to the grade shown. The trench shall not be backfilled until all specified tests are performed.

3.2.1.1 Replacement of Unyielding Material

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

3.2.1.2 Replacement of Unstable Material

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

3.2.1.3 Bedding and Initial Backfill

Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least 1 foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

3.2.1.4 Final Backfill

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

a. Roadways and Paved Areas: Backfill shall be placed up to the elevation at which the requirements in section 02210, GRADING shall control. Water flooding or jetting methods of compaction will not be permitted.

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

3.2.2 Backfill for Appurtenances

After the manhole, catch basin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 7 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.3 SPECIAL REQUIREMENTS

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

3.3.1 *Omitted*

3.3.2 Water Lines

Trenches shall be of a depth to provide a minimum cover of 3 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.3.3 Heat Distribution Systems

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

3.3.4 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated.

3.3.5 Plastic Marking Tape

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

3.4 TESTING

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

3.4.1 Testing Facilities

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

### 3.4.2 Testing of Backfill Materials

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

### 3.4.3 Field Density Tests

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one laboratory moisture-density relation test and companion classification test shall be performed on each different type of material used for backfills. Under areas to be paved, one sand cone density test shall be performed for each alternate lift of backfill in trenches at increments of 100 feet or fraction thereof. In other areas, one sand cone density test shall be performed on each lift of backfill at interval spacings of 200 linear feet of trench, or fraction thereof. Field in-place density shall be determined in accordance with ASTM D 1556. Copies of test results shall be furnished to the Contracting Officer within 24 hours of conclusion of the tests. In addition, daily density tests shall be recorded by the Contractor on CESAS Form 1177, Summary of Field Density Test, and an updated copy furnished to the Contracting Officer weekly. Government forms will be furnished to the Contractor. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government. Testing procedures to control compaction and to relate field density data to laboratory test values shall be as specified in section 02221A, EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS, paragraph TESTING.

### 3.4.4 Displacement of Sewers

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

## 3.5 REPLACEMENT OF EXISTING PAVEMENT

The replacement shall be made with pavements similar to the type removed in accordance with the following:

### 3.5.1 *Omitted*

### 3.5.2 Flexible Pavement

Replacement shall be made with a base course and bituminous surface course (hot plant mix), meeting the basic requirements of GADOT Standard Specification for Roads, and Structures. Prior to placing the base course, the subgrade shall be thoroughly compacted to the required density. The construction of the base course and surface course shall be such that the pavement shall be similar and equal to the adjoining pavement.

SECTION 02233

GRADED-CRUSHED-AGGREGATE BASE COURSE

PART 1 GENERAL

This Section applies to the base course directly beneath the bituminous surface course and will be used for any such course that has a design California Bearing Ratio (CBR), under MIL-STD 621, of 100 or more, and in areas where specified on Plans.

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM C 29 | (1991a) Unit Weight and Voids in Aggregate |
| ASTM C 88 | (1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate |
| ASTM C 117 | (1990) Materials Finer Than 75-micrometer (No. 200) Sieve in Mineral Aggregates by Washing |
| ASTM C 131 | (1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine |
| ASTM C 136 | (1993) Sieve Analysis of Fine and Coarse Aggregates |
| ASTM D 75 | (1987; R 1992) Sampling Aggregates |
| ASTM D 1556 | (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method |
| ASTM D 1557 | (1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.)) |
| ASTM D 2167 | (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method |
| ASTM D 2487 | (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System) |
| ASTM D 4318 | (1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils |
| ASTM E 11 | (1993) Wire-Cloth Sieves for Testing Purposes |
| ASTM E 548 | (1994) General Criteria Used for Evaluating Laboratory Competence |

1.2 OMITTED

1.3 UNIT PRICES

Work shall be performed under lump sum contract.

1.3.2.2 Stabilization of Cohesionless Subgrade or Subbase Courses

Stabilization of cohesionless subgrade or subbase courses, as specified in paragraph PREPARATION OF UNDERLYING COURSE, will be paid for as a special item on a tonnage basis including extra manipulation as required.

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-09 Reports

Sampling and Testing; FIO.

Copies of field test results.

SD-18 Records

Waybills and Delivery Tickets; FIO.

Copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all aggregates actually used.

1.5 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557. This will be abbreviated herein as percent of laboratory maximum density.

1.6 EQUIPMENT

1.6.1 Approval

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.6.2 Weather Limitation

Base courses shall be placed when the atmospheric temperature is above 2 degrees C (35 degrees F). Areas of completed base course that are damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirement.

1.7 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor subject to approval. If the Contractor elects to establish testing facilities of his own, approval of such facilities shall be based on compliance with ASTM E 548, and no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved.

The first inspection of the facilities shall be at the expense of the Government and any subsequent inspections required because of failure of the first inspection will be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor. The materials shall be tested to establish compliance with the specified requirements. Copies of test results shall be furnished to the Contracting Officer.

1.7.1 Sampling

Sampling for material gradation, liquid limit, and plastic limit tests shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.7.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.7.2.1 Sieve Analyses

Sieve analyses shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

1.7.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.7.2.3 Density Tests

*3 Density shall be measured in the field in accordance with ASTM D ~~2922~~ 2167. ~~For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted if necessary using only the sand cone method as described in paragraph Calibration of the ASTM publication. Tests performed in accordance with ASTM D 2922 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 by the prepared containers of material method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed.~~

1.7.2.4 Soundness Test

Soundness tests shall be made in conformance with ASTM C 88.

1.7.2.5 Wear Test

Wear tests shall be made in conformance with ASTM C 131.

1.7.3 Approval of Material

The source of the material to be used for producing aggregates shall be selected 15 days prior to the time the material will be required in the work. Tentative approval of the source will be based on an inspection by the Contracting Officer. Tentative approval of material will be based on tests of samples for the specific job. Final approval of both the source and the material will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted subbase course.

PART 2 PRODUCTS

## 2.1 AGGREGATES

Aggregates shall consist of clean, sound, durable particles of crushed stone, crushed slag, or crushed gravel, and screenings. The Contractor shall obtain materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein, after all compaction and proof-rolling operations have been completed. Slag shall be an air-cooled, blast-furnace product having a dry weight of not less than 1050 kg per cubic meter (65 pcf) as determined by ASTM C 29. The aggregates shall be free of silt and clay as defined by ASTM D 2487, vegetable matter, and other objectionable materials or coatings. The portion retained on the 4.75 mm (No. 4) sieve shall be known as coarse aggregate; that portion passing the 4.75 mm (No. 4) sieve shall be known as fine aggregate.

### 2.1.1 Coarse Aggregates

Coarse aggregates shall be angular particles of uniform density. The coarse aggregate shall have a loss not greater than 10 percent weighted averaged at five cycles when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The coarse aggregate shall have a percentage of wear not to exceed 40% after 500 revolutions as determined by ASTM C 131. The percentage of flat and/or elongated particles shall not exceed 20 in the fraction retained on the 12.5 mm (1/2 inch) sieve and in the fraction passing the 12.5 mm (1/2 inch) sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein. Crushed gravel shall be manufactured from gravel particles 90 percent of which by weight are retained on the maximum-size sieve listed in TABLE I. In the portion retained on each sieve specified, the crushed gravel shall contain at least 90 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 place. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces.

### 2.1.2 Fine Aggregate

Fine aggregate shall be angular particles produced by crushing stone, slag, or gravel that meets the requirements for wear and soundness specified for coarse aggregate. Fine aggregate shall be manufactured from gravel particles 95 percent of which by weight are retained on the 12.5 mm (1/2 inch) sieve.

### 2.1.3 Gradation Requirements

Gradation requirements specified herein shall apply to the completed base course. The aggregates shall have a maximum size of 25 millimeters (1- inch) and be graded continuously well within the limits specified in TABLE I. Sieves shall conform to ASTM E 11.

TABLE I. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

| Sieve Designation | No. 1 | No. 2 | No. 3 |
|---|---|---|---|
| 50.0 mm | 100 | -- | -- |
| 37.5 mm | 70-100 | 100 | -- |
| 25 mm | 45-80 | 60-100 | 100 |
| 12.5 mm | 30-60 | 30-65 | 40-70 |
| 4.75 mm | 20-50 | 20-50 | 20-50 |

| | | | |
|---|---|---|---|
| 2 mm | 15-40 | 15-40 | 15-40 |
| 0.425 mm | 5-25 | 5-25 | 5-25 |
| 0.075 mm | 0-10 | 0-10 | 0-10 |

TABLE I. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

| Sieve Designation | No. 1 | No. 2 | No. 3 |
|---|---|---|---|
| 2-inch | 100 | -- | -- |
| 1-1/2 inch | 70-100 | 100 | -- |
| 1 inch | 45-80 | 60-100 | 100 |
| 1/2 inch | 30-60 | 30-65 | 40-70 |
| No. 4 | 20-50 | 20-50 | 20-50 |
| No. 10 | 15-40 | 15-40 | 15-40 |
| No. 40 | 5-25 | 5-25 | 5-25 |
| No. 200 | 0-10 | 0-10 | 0-10 |

NOTE 1: Particles having diameters less than 0.02 mm shall not be in excess of 3 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves may require appropriate correction by the Contracting Officer when aggregates of varying specific gravities are used.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements stated herein shall apply to any aggregate component that is blended to meet the required gradation and also to the aggregate in the completed base course. The portion of the aggregate passing the 0.425 mm (No. 40) sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 OPERATION OF AGGREGATE SOURCES

Clearing, stripping, and excavating shall be the responsibility of the Contractor. The aggregate sources shall be operated in such a manner as to produce the quantity and quality of base course materials meeting these specification requirements in the specified time limits. Upon completion of the work, the aggregate sources on Government reservations shall be conditioned to drain readily and be left in a satisfactory condition. Aggregate sources on private lands shall be conditioned in agreement with local laws or authorities.

3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.3 PREPARATION OF UNDERLYING COURSE

Prior to constructing the crushed-aggregate base course, the underlying course shall be cleaned of all foreign substances. At the time of construction of the base course, the underlying course shall contain no frozen material. The underlying course shall conform to Section 0513 GRADED-CRUSHED-AGGREGATE BASE COURSE. Ruts or soft, yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels as defined in ASTM D 2487 the surface shall be stabilized prior to placement of the graded-crushed-aggregate base course. Stabilization shall be accomplished by mixing graded-crushed-aggregate base material into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the base course is placed.

## 3.4 GRADE CONTROL

During construction, the lines and grades including crown and cross slope indicated for the base course shall be maintained by means of line and grade stakes placed by the Contractor.

## 3.5 MIXING OF MATERIALS

The coarse and fine aggregates shall be mixed in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. The Contractor shall make such adjustments in mixing procedures or in equipment as may be directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification.

## 3.6 PLACING

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 150 mm (6 inches) or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 150 mm (6 inches) is required, the material shall be placed in layers of equal thickness. No layer shall exceed 150 mm (6 inches) or be less than 80 mm (3 inches) when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable base course.

## 3.7 COMPACTION

### 3.7.1 Requirements

*1 Each layer of base course ~~[including shoulders]~~ including shoulders shall be compacted as specified to produce an average field-measured density, through the full depth, of at least 100 percent of laboratory maximum density obtained in the laboratory. Water content shall be maintained during the compaction procedure and subsequent proof rolling of designated areas such that the water content is within plus or minus 2 percent of optimum water content as determined from laboratory tests as specified in density test procedures listed in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the base course material shall be compacted with mechanical tampers.

### 3.7.2 Finishing

The surface of top layer of base course shall be finished after final compaction, and proof rolled, where required, by cutting any overbuild to grade and rolling with a steel-wheeled roller. In no case will thin layers of material be added to the top layer of base course to meet grade. If the elevation of top layer of base course is 10 mm (1/2 inch) or more below the grade, the top layer of base shall be scarified to a depth of at least 80 mm (4 inches), new material shall be added, and the layer shall be blended and recompacted to bring to grade. Adjustments in rolling and finishing procedures shall be made as may be directed to obtain grades, to minimize segregation and degradation of base course material, to adjust the water content, and to insure an acceptable base course. Material found unacceptable shall be removed and replaced, as directed, with acceptable material.

## 3.8 PROOF ROLLING

Proof rolling of the areas designated shall be in addition to compaction specified above and shall consist of application of 30 coverages with a heavy pneumatic-tired roller having four tires abreast, with each tire loaded to 13.6 metric tons (30,000 pounds) and tires inflated to 1.035 MPa (150 psi). In the areas designated, proof rolling shall be applied to the top lift of layer on which the base course is laid and to each layer of the base course. Water content of the lift of the layer on which the base course is placed, and of each layer of the base course, shall be maintained at optimum, or at the percentage directed from the start of compaction to the completion of proof rolling. Materials in the base course or underlying materials indicated unacceptable by the proof rolling shall be removed and replaced, as directed, with acceptable materials.

## 3.9 EDGES OF BASE COURSE

Acceptable material shall be placed along the edges of the base course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 0.30 m (1 foot) width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the base course, as directed.

## 3.10 SMOOTHNESS TEST

The surface of the top layer shall not deviate more than 9.5 mm (3/8 inch) when tested with a 5.05 m (10-foot) straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding 9.5 mm (3/8 inch) shall be corrected as directed.

## 3.11 THICKNESS CONTROL

The completed thickness of the base course shall be within 12.7 mm (1/2 inch) of the thickness indicated. The thickness of the base course shall be measured at intervals providing at least one measurement for at least each 400 square meters (500 square yards) of base course. The depth measurement shall be made by test holes at least 76.2 mm (3 inches) in diameter. Where the measured thickness of the base course is more than 12.7 mm (1/2 inch) deficient, such areas shall be corrected by excavating to the required depth and replacing with new material. Where the measured thickness of the base course is 12.7 mm (1/2 inch) more than indicated, it will be considered as conforming with the requirements plus 12.7 mm (1/2 inch), provided the surface of the base course is within 12.7 mm (1/2 inch) of established grade. The average job thickness shall be the average of the job measurements as specified above but within 6.4 mm (1/4 inch) of the thickness indicated.

## 3.12 MAINTENANCE

The base course shall be maintained in a condition that will meet all specification requirements until accepted.

-- End of Section --

*12

SECTION 02225

EQUIPMENT AND STRUCTURE DECONTAMINATION

1. SCOPE: In the event that contaminated soil and/or ground water are discovered during construction activities, decontamination will be required to prevent movement of contaminants to clean areas off site, and shall be performed prior to demobilizing the equipment or moving equipment beyond designated limits as identified by the Contracting Officer.

2. GENERAL: The Contractor shall be responsible for constructing an equipment decontamination station in a location as approved by the Contracting Officer for removing contamination from all vehicles and removal equipment leaving the work area. The decontamination facility shall consist of the following minimum construction features:

Impermeable liner of 30 mil minimum thickness (PVC, HDPE, or other material approved by Contracting Officer).

Curbing at least 6 inches in height around the lined area to control rinse water.

Sloping construction to promote rinse water drainage to a central collection sump or area for removal.

Additional protective cover material as approved by Contracting Officer, (plywood, grating, etc.) to prevent puncture of the liner by vehicle tracking or placement of equipment during decontamination.

A special "clean area" shall be established on the decontamination pad for performing equipment maintenance. This area should be used when personnel are required by normal practices to expose themselves to contact with the ground soil, e.g., crawling under vehicle to change engine oil. All equipment being decontaminated by washdown shall be located in the decontamination area prior to maintenance work.

The decontamination area shall be considered a contaminated work area. Personnel engaged in vehicle decontamination shall wear protective equipment as required in the Contractor's Site Safety and Health Plan.

Any item taken into the contaminated area must be assumed to be contaminated and must be decontaminated before the item leaves the area. Vehicles, equipment, and/or materials brought into the contaminated area will remain there until no longer necessary to complete the work. The only travel allowed the Contractor in transportation of contaminated vehicles, equipment, and/or materials will be the direct route between the site of the work and the decontamination area as designated by the Contracting Officer.

Decontamination rinse water shall be handled as specified in the Contractor's Plan of Operations and Health and Safety Plan in accordance with SECTION: 01110 SAFETY, HEALTH, AND EMERGENCY RESPONSE.

END OF SECTION

SECTION 02285

SOIL TREATMENT FOR SUBTERRANEAN TERMITE CONTROL

PART 1 GENERAL

1.1 *OMITTED*
1.2 *OMITTED*

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

Qualifications; ~~GA~~ FIO.

Qualifications of the pesticide applicator.

SD-06 Instructions

*3 Pesticides; ~~GA~~ FIO.

Manufacturer's label and Material Safety Data Sheet (MSDS) for pesticides proposed for use.

SD-14 Samples

*3 Pesticides; ~~GA~~ FIO.

Samples of the pesticides used in this work, upon request.

1.4 QUALIFICATIONS OF PESTICIDE APPLICATORS

The pesticide applicator's principal business shall be pest control and the pesticide applicator shall be State certified in the U.S. Environmental Protection Agency (EPA) pesticide applicator category which includes structural pest control, and certified in the State.

1.5 DELIVERY, STORAGE, AND HANDLING

Pesticides shall be delivered to the project site in sealed and labeled containers in good condition as supplied by the manufacturer or formulator. Pesticides shall be stored, handled, and used in accordance with manufacturer's labels. Labels shall bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended.

1.6 SAFETY REQUIREMENTS

The Contractor shall formulate, treat, and dispose of termiticides and their containers in accordance with label directions. Water for formulating shall only come from sites designated by the Contracting Officer, and filling hose

shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Pesticides and related materials shall be kept under lock and key when unattended. Proper protective clothing and equipment shall be worn and used during all phases of termiticide application.

1.7 WARRANTY

The Contractor shall provide a 5-year written warranty against infestations or reinfestations by subterranean termites of the buildings or building additions constructed under this contract. Warranty shall include annual inspections of the building[s] or building addition[s]. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and the soil and building conditions have not been altered in the interim, the Contractor shall:

a. Retreat the soil and perform other treatment as may be necessary for elimination of subterranean termite infestation;

b. Repair damage caused by termite infestation; and

c. Reinspect the building approximately 180 days after the pretreatment.

PART 2 PRODUCTS

2.1 MATERIALS

Termiticides shall be currently registered by the EPA.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

At the time of application, the soil moisture content shall be sufficiently low to allow uniform distribution of the treatment solution throughout the soil. Applications shall not be made during or immediately following heavy rains or when conditions may cause runoff and create an environmental hazard.

3.2 APPLICATION

3.2.1 Treatment of New Structures

The Contractor shall establish complete and unbroken vertical and/or horizontal (as necessary) soil poison barriers between the soil and all portions of the intended structure which may allow termite access to wood and wood related products. Application shall not be made to areas intended for use as a plenum air space. Surface treatments shall not be made for areas to serve as crawl spaces. Termiticide shall be applied as a coarse spray and provide uniform distribution unto the soil surface. Treatment shall be applied prior to placement of a vapor barrier or waterproof membrane and at least 12 hours prior to concrete placement. Where treated soil or fill material is not to be covered with a vapor barrier or waterproof membrane, adequate precautions shall be taken to prevent its disturbance. Soil or fill material disturbed after treatment shall be retreated as specified above before placement of slabs or other covering structures. Treatment of the soil on the exterior sides of foundation walls, grade beams, and similar structures shall be coordinated with final grading and planting operations so as to avoid disturbance of the treated barriers. Manufacturer's warnings and precautions shall be observed in the handling and use of such materials. Care shall be taken to prevent these chemicals from entering water supply systems, potable

water supplies, or aquifers; and that they do not endanger plants or animals. The Contracting Officer shall be notified at least 48 hours prior to beginning of treatment and formulating, mixing, and application shall be performed in the presence of the Contracting Officer's representative.

3.2.2 *Omitted*

3.2.3 Rates and Methods of Application

Rates and methods of application shall be in accordance with the manufacturer's instructions on the pesticide label. Maximum application or dosage rates shall be used. If the pesticide contains less than the amount of active ingredient specified on the label, work shall be repeated with pesticides conforming to this specification.

3.3 DISPOSAL

The Contractor shall dispose of residual pesticides and containers off Government property in accordance with label instructions and EPA criteria.

-- End of Section --

SECTION 02511

CONCRETE SIDEWALKS AND CURBS AND GUTTERS

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 185 | (1990a) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement |
| ASTM A 615 | (1990) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement |
| ASTM A 616 | (1990) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement |
| ASTM A 617 | (1990) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement |
| ASTM C 31 | (1991) Making and Curing Concrete Test Specimens in the Field |
| ASTM C 143 | (1990a) Slump of Hydraulic Cement Concrete |
| ASTM C 171 | (1991) Sheet Materials for Curing Concrete |
| ASTM C 172 | (1990) Sampling Freshly Mixed Concrete |
| ASTM C 173 | (1978) Air Content of Freshly Mixed Concrete by the Volumetric Method |
| ASTM C 231 | (1991b) Air Content of Freshly Mixed Concrete by the Pressure Method |
| ASTM C 309 | (1991) Liquid Membrane-Forming Compounds for Curing Concrete |
| ASTM D 1751 | (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |
| ASTM D 1752 | (1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction |

CORPS OF ENGINEERS (COE)

| | |
|---|---|
| COE CRD-C 527 | (1988) Standard Specification for Joint Sealants Cold-Applied, Non-Jet-Fuel-Resistant, for Rigid and Flexible Pavements |

FEDERAL SPECIFICATIONS (FS)

| | |
|---|---|
| FS CCC-C-467 | (Rev C) Cloth, Burlap, Jute (or Kenaf) |
| FS SS-S-1401 | (Rev C; Notice 1) Sealant, Joint, Non-Jet-Fuel-Resistant, Hot-Applied, for Portland Cement and Asphalt Concrete Pavements |

1.2 *Omitted*
1.3 *Omitted*

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-09 Reports

Field Quality Control; FIO.

Copies of all test reports within 24 hours of completion of the test.

SD-18 Records

Concrete; FIO.

Copies of certified delivery tickets for all concrete used in the construction.

1.5 WEATHER LIMITATIONS

1.5.1 Placing During Cold Weather

Concrete placement shall be discontinued when the air temperature reaches 5 degrees C (40 degrees F) and is falling. Placement may begin when the air temperature reaches 2 degrees C (35 degrees F) and is rising. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 2 degrees C, (35 degrees F,) placement shall be approved in writing. Approval shall be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 10 and 30 degrees C (50 and 85 degrees F). Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 10 degrees C (50 degrees F) for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.5.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 30 degrees C (85 degrees F) except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 35 degrees C (90 degrees F).

## 1.6 PLANT, EQUIPMENT, MACHINES, AND TOOLS

### 1.6.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

### 1.6.2 Slip Form Equipment

Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler-mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in one pass.

# PART 2 PRODUCTS

## 2.1 CONCRETE

Concrete shall conform to the applicable requirements of Section 02513 CONCRETE PAVEMENT FOR ROADS AND AIRFIELDS except as otherwise specified. Concrete shall have a minimum compressive strength of 24 MPa (3,500 psi) at 28 days. Maximum size of aggregate shall be 37.5 mm (1-1/2 inches).

### 2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

### 2.1.2 Slump

The concrete slump shall be 101 millimeters (4 inches) where determined in accordance with ASTM C 143.

### 2.1.3 Reinforcement Steel

Reinforcement bars shall conform to Grade 60 for bars No. 3 and larger, and Grade 80 for No. 2 bars - ASTM A-675.

## 2.2 CONCRETE CURING MATERIALS

### 2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

### 2.2.2 Burlap

Burlap shall conform to FS CCC-C-467.

### 2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

## 2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

## 2.4 JOINT FILLER STRIPS

### 2.4.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard. Isolation and expansion joint material shall meet ASTM D-1751 or ASTM D-1752.

### 2.4.2 Expansion Joint Filler, Premolded Asphalt-Impregnated Expansion Joint Material

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 9.5 mm (3/8 inch) thick, unless otherwise indicated.

## 2.5 JOINT SEALANTS

### 2.5.1 Joint Sealant, Cold-Applied

Joint sealant, cold-applied shall conform to COE CRD-C 527.

### 2.5.2 Joint Sealant, Hot-Poured

Joint sealant, hot-poured shall conform to FS SS-S-1401.

## 2.6 FORM WORK

Form work shall be designed and constructed to insure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 50 mm (2-inch) nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 3 m (10 feet). Radius bends may be formed with 19 mm (3/4 inch) boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 3 m (10 feet) with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

### 2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

### 2.6.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank

forms may be used for curb or curb returns with a radius of 3 m (10 feet) or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 38 mm (1-1/2 inch) benders, for the full height of the curb, cleated together.

## PART 3 EXECUTION

### 3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted to conform with applicable requirements
of this section.

#### 3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

#### 3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

#### 3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected so as to produce a subgrade free from frost when the concrete is deposited.

### 3.2 FORM SETTING

Forms shall be carefully set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of three stakes per form placed at intervals not to exceed 1.2 meters (4 feet). Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

#### 3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 3 mm (1/8 inch) in any 3 m (10-foot) long section. After forms are set, grade and alignment shall be checked with a 3.05 m (10-foot) straightedge. Forms shall have a transverse slope ~~[as indicated] [of 20 millimeters per meter (1/4 inch per foot)]~~ as indicated with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

*2

### 3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

## 3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

### 3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer of such thickness that when consolidated and finished the sidewalks will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a wood float, bull float, or darby, edged and broom finished.

### 3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic.

### 3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 3 mm (1/8 inch). Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

### 3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 7.9 mm (5/16 inch) from the testing edge of a 3.05 m (10-foot) straightedge. Permissible deficiency in section thickness will be up to 6.4 mm (1/4 inch).

## 3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

### 3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators.

### 3.4.2 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 13 mm (1/2 inch). Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter

and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

3.4.3 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

3.4.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 6.4 mm (1/4 inch) from the testing edge of a 3.05 m (10-foot) straightedge. Permissible deficiency in section thickness will be up to 6.4 mm (1/4 inch).

3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at a distance equal to the sidewalk width or 1.5 m (5 feet) on centers, whichever is less, and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks 3 m (10 feet) or more in width. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

3.5.1 Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 3 mm (1/8 inch) blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the job site at all times during the sawing operations.

3.5.2 Expansion Joints

Expansion joints shall be formed with 9.5 mm (3/8) inch joint filler strips. Joint filler shall be placed with top edge 6 mm (1/4 inch) below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 3 mm (1/8 inch), and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer.

The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 10 degrees C (50 degrees F) at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.5.3 Reinforcement Steel Placement

Reinforcement steel shall be accurately and securely fastened in place with suitable supports and ties before the concrete is placed.

## 3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

### 3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 1.5 m (5 feet) nor greater than 4.5 m (15 feet) in length. Contraction joints shall be constructed by means of 3 mm (1/8 inch) thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

### 3.6.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 9.5 mm (3/8) inch in width shall be provided at intervals not exceeding 9.14 meters (30 feet). Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit.

Expansion joints and the top 1 inch depth of curb and gutter contraction-joints shall be sealed with joint sealer. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing shall be done so that the material will not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 10 degrees C (50 degrees F) at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

## 3.7 CURING AND PROTECTION

### 3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

#### 3.7.1.1 Mat Method

The entire exposed surface shall be covered with two or more layers of burlap. Mats shall overlap each other at least 150 mm (6 inches). The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.7.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 300 mm (12 inches) when a continuous sheet is not used. The curing medium shall not be less than 450 mm (18 inches) wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

3.7.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 5 square meters per liter (200 square feet per gallon) for both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the job site for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for

the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

3.7.4 Protective Coating

Protective coating of linseed oil mixture shall be applied to the exposed-to-view concrete surface.

3.7.4.1 Application

Curing and backfilling operation shall be completed prior to applying protective coating. Concrete shall be surface dry and thoroughly clean before each application. Coverage shall be not more than 11 square meters per liter (50 square yards per gallon) for first application and not more than 15.5 square meters per liter (70 square yards per gallon) for second application, except that the number of applications and coverage for each application for commercially prepared mixture shall be in accordance with the manufacturer's instructions. Coated surfaces shall be protected from vehicular and pedestrian traffic until dry.

3.7.4.2 Precautions

Protective coating shall not be heated by direct application of flame or electrical heaters and shall be protected from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Material shall not be applied at temperatures lower than 10 degrees C (50 degrees F).

3.8 FIELD QUALITY CONTROL

3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

3.8.2 Concrete Testing

3.8.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 190 cubic meters (250 cubic yards) of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31 by an approved testing laboratory. Each strength test result shall be the average of two test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 4 MPa (500 psi).

3.8.2.2 Air Content

Air content shall be determined in accordance with ASTM C 173 or ASTM C 231. ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly

selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.8.2.3 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 190 cubic meters, (250 cubic yards,) or fraction thereof, of concrete placed during each shift. Additional tests will be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noticed along the edges of slip-formed concrete.

3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

3.9 SURFACE DEFICIENCIES AND CORRECTIONS

3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 6 mm (1/4 inch) the deficient section will be removed, between regularly scheduled joints, and replaced.

3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 6 mm (1/4 inch). All pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

-- End of Section --

SECTION 02550

BITUMINOUS PAVEMENT

(Modified State of Georgia Department of Transportation
Specification for Less Than 1,000 Tons)

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

The work specified herein comprises the construction of a bituminous pavement consisting of a graded aggregate base course, bituminous prime coat, bituminous tack coat, and bituminous surface course (central plant hot mix). The subgrade for the base course shall be prepared in accordance with the Grading Section of these specifications. The construction of the bituminous pavement shall conform to the requirements of the "Department of Transportation, State of Georgia, Standard Specifications, Construction of Roads and Bridges, 1993 Edition," except for the modifications or additions specified herein.

1.2 DEFINITIONS:

Wherever in the Department of Transportation, State of Georgia Standard Specifications, hereinafter referred to in this section as the "Standard Specifications," the following terms are used, the intent shall be understood as follows:

"State" ---------- U.S. Government

"Department" ---------- Corps of Engineers, Party of the First Part

"Engineer" ---------- Contracting Officer, Corps of Engineers

"Proposal Form" ---------- General Clauses, Special Clauses or Technical Specifications

1.3 ESTABLISHMENT OF JOB-MIX FORMULA, INCLUDING SAMPLING AND TESTING

The bituminous plant mix surface course (hot plant mix) shall be applied in accordance with the Standard Specifications using asphaltic concrete Type "E" for roads and Type "F" for POV parking lots and entrance drives connected thereto.

1.3.1 Establishment

When the estimated quantity of bituminous pavement mixture is greater than 300 tons but less than 1,000 tons the job-mix formula together with all pertinent laboratory and field test data shall be furnished the Contracting Officer for review and approval at least 45 days prior to beginning paving operations. Simultaneously, the same job-mix formula and test data together with sufficient sized samples and source of materials shall be furnished the Director, U.S. Army Corps of Engineers, South Atlantic Division Testing Laboratory, 611 South Cobb Drive, Marietta, Georgia 30060 for review and check testing by the Government.

1. 3.2 Sampling and Testing

The above mentioned samples and test data concerning the satisfactoriness of all materials in the mixture to be used in this work, including the Marshall test properties, shall be furnished for approval by the Contracting Officer as specified above, except for small projects where the plant mixture is 300 tons and less as specified below. The Division Testing Laboratory will notify the Contracting Officer of the satisfactoriness of the proposed mix design prior to the Contractor beginning placement of pavement. The Contractor shall perform the necessary density tests of the compacted base course and the compacted bituminous surface course as directed at no additional cost to the Government.

When the estimated quantity of bituminous plant mixture is less than 300 tons, manufacturers' certificates of compliance for the materials, job-mix formula, and copies of tests of the bituminous plant mixture furnished for the project shall be acceptable in lieu of actual field and laboratory testing by the Government as described above, excluding sampling and testing required for job quality control during construction as specified hereinafter in paragraph TESTING.

1.4 TRIAL OPERATION:

1.4.1 Test Mix Run

A trial operation of the bituminous mixing plant will be required. However, this requirement may be waived by the Contracting Officer if the Contractor obtains the bituminous mixture from a plant that is already in operation and producing a mixture meeting these specifications. The waiver will be based on the Contractor furnishing plant records verifying that the test requirements listed below are being met.

1.4.2 Batching, Mixing, and Testing

Not less than 2 days prior to commencement of paving, a test of the batching and mixing plant shall be made in order to check operational efficiency. The number of full scale bituminous batches required will be determined by the Contracting Officer. All of these batches will be wasted or used for purposes other than paving covered by these specifications.

The following are tests to be performed on each test batch:

Computation of theoretical specific gravity
Mix temperature
One extraction (bitumen content and sieve analysis of extracted aggregate)
One set of Marshall specimens* (set of three)

(*Temperature of mixtures immediately prior to compaction shall be 250 degrees F., plus or minus 5 degrees.)

Perform the following tests on each of the three Marshall specimens:

Stability
Flow
Unit weight
Percent voids total mix
Percent voids filled

1.4.3 Hot Bin Proportioning

Before the "trial operation" begins, the Contractor will "charge" the separate hot bins of each size aggregate through the rescreening plant at the Mixing Plant in the manner the Contractor proposes to use during paving operations. A sieve analysis will be made on each hot bin to determine proportions which will produce a combined gradation conforming to the job-mix formula. This process should be repeated a minimum of three sets on each hot bin to check the consistency of the rescreening plant and the aggregates for conformance to the job-mix formula. All labor and facilities shall be provided by the Contractor and the testing will be under the supervision of the Contracting Officer.

1.4.4 Test Results

Results of tests shall be compared to test results from the approved job-mix formula for compliance. Necessary adjustments, corrections, etc., will be made at this time. The entire cost of the "trial operation," including labor, equipment, materials, and testing facilities will be at the expense of the Contractor without any additional cost to the Government.

PART 2 MATERIALS AND INSTALLATION:

2.1 Graded Aggregate Base

Base for the paving shall be graded aggregate base course as described in Section 02233 - GRADED-CRUSHED-AGGREGATE BASE COURSE. The construction of the base course shall adhere to the requirements of Section 310 of the Standard Specifications. Coarse aggregate shall be Class A, Group II.

2.2 Prime Coat

Bituminous prime coat shall be applied in accordance with Section 412 of the Standard Specifications. The prime coat shall be Grade RC 30 or MC 30 or RC 70 or MC 70, applied at the Ga. D.O.T. standard rate of 0.15 to 0.30 gallon per square yard. Emulsified asphalt may be used upon approval of the Contracting Officer and shall meet the following standardsfor asphaltic cement, viscosity grade AC-10, AC-15, AC-20, or AC-30.

2.3 Bituminous Tack Coat

If the prime coat is not fresh, clean, and free of traffic marks, a bituminous tack coat shall be applied immediately prior to application of the asphaltic concrete surface course. The tack coat shall be applied in accordance with Section 413 of the Standard Specifications using 0.08 to 0.15 gallon per square yard of emulsified asphalt Grade SS-1. Cutback asphalt may be used upon approval of the Contracting Officer.

2.4 Bituminous plant mix surface course(s)

Bituminous plant mix surface course(s) shall be applied in accordance with Section 400 of the Standard Specifications using asphaltic concrete Type "E" or "F" as listed below. Mix designs shall be approved by the Contracting Officer before being used in the work, as specified hereinbefore in paragraph Establishment of Job-Mix Formula.

2.4.1 Composition:

| Asphaltic Concrete | Type "E" | Type "F" | |
|---|---|---|---|
| Coarse Aggregate Size | 78 and screenings | 89 and screenings | *Asphalt Cement |
| Penetration Grade | 85 - 100 | 85 - 100 | |

2.4.2 Percent Passing by Weight:

| | | |
|---|---|---|
| 3/4 inch | 100 | - |
| ½ inch | 85 - 100 | 100 |
| 3/8 inch | 70 - 85 | 90 - 100 |
| No. 4 | - | 55 - 75 |
| No. 8 | 44 - 48 | 44 - 50 |
| No. 50 | 10 - 25 | 12 - 28 |
| No. 200 | 4 - 7 | 4 - 7 |

2.4.3 Additional Requirements:

| | | |
|---|---|---|
| Flow | 8 - 16 | 8 - 16 |
| Minimum stability based on 50-blow Marshall Test (pounds) | 1,500 | 1,500 |
| Temperature of mixture prior to compaction (degrees F.) | 245 - 255 | 245 - 255 |
| Percentage of voids in mixture | 4 - 5 | 4 - 5 |
| Percentage aggregate voids filled with asphalt cement | 70 - 82 | 70 - 82 |

2.4.4 Aggregate Proportions of Asphaltic Concrete Type "E":

40% Size No. 78 Stone
60% Screenings

2.4.5 Approximate Job Mix Asphaltic Concrete:

| | Percent Passing | | |
|---|---|---|---|
| Sieve Size | Type "E" | | Type "F" |
| 3/4 inch | 100 | | -- |
| ½ inch | 98 | | 100 |
| 3/8 inch | 82 | Percent bitumen by | 97 |
| No. 4 | 62 | weight of total | 67 |
| No. 8 | 45 | mixture is 5.75 for | 45 |
| No. 50 | 18 | Type "E" and 6.00 | 15 |
| No. 200 | 8 | for Type "F" | 6 |

*The Contractor has the option of using asphalt cement meeting the following viscosity grade requirements:

PROPERTIES FOR PETROLEUM ASPHALT CEMENTS

| | Viscosity Grade AC-20 | |
|---|---|---|
| | Minimum | Maximum |
| Viscosity, 140 degrees F. (60 degrees C.), poises | 2,000 | +/- 400 |
| Viscosity, 275 degrees F. (135 degrees C.), Cs | 300 | - |
| Penetration, 77 degrees F. (25 degrees C.), 100g., 5 sec. | 60 | - |
| Flash Point, COC, C. (F.) | 232 (450) | - |
| Solubility in trichlorethylene, % | 99.0 | - |
| Tests on Residue from Thinfilm Oven Test: | | |
| Viscosity, 140 degrees F. (60 degrees C.), poises | - | 10,000 |
| Ductility, 25 degrees C. (77 degrees F.), | | |

| | | |
|---|---|---|
| 5cm per min., cm | | 50 |
| - | | |
| Spot Test | | Negative - |

| | |
|---|---|
| Kinematic Viscosity | AASHTO: T 201 |
| Absolute Viscosity | AASHTO: T 202 |

2.5 COPIES OF SPECIFICATIONS

During the performance of all work covered in this section, the Contractor shall keep two copies of the referenced "Standard Specifications" at the job site.

2.6 SAMPLING PAVEMENTS AND MIXTURES

Samples of finished pavement, including samples that span the longitudinal joint, shall be obtained by the Contractor. Sizes of samples shall be adequate to determine conformance to density, thickness, and other specified requirements. Tests shall be the responsibility of the Contractor. The Contractor shall furnish a power saw or core drill and labor for cutting samples, and shall backfill the holes with fresh paving mixture thoroughly compacted to the finished surface and grade. Samples shall be taken at start of paving operations and at intervals throughout paving operations as directed. Samples of plant mixtures shall also be taken from the truck and tested by the Contractor to determine conformance to specified pavement test properties, bitumen content, and gradation requirements. When possible, the finished pavement sample shall be located in the paved area representative of the plant mixture previously sampled from the truck.

2.6.1 Compaction of Pavement

The bituminous plant mix shall be compacted to a density of at least 95 percent of the laboratory density, as determined by the Marshall method of test specified herein.

2.7 TESTING:

2.7.1 General

Tests shall be required of samples taken from the pavement as specified above in paragraph SAMPLING PAVEMENTS AND MIXTURES, and for control testing as specified below. All test reports will be maintained by the Contractor Quality Control Team. Any test that fails to meet the specified requirements shall be immediately reported to the Contracting Officer with their recommended corrective action. In addition and under the direction of the Contractor Quality Control Team, duplicate samples* of the materials, pavement mixtures, and pavement samples* representing 10 percent of the samples used for job control shall be shipped by the Contractor at his own expense to the South Atlantic Division Testing Laboratory referenced hereinbefore. The testing of these 10 percent control samples for verification purposes will be performed by the Government at no cost to the Contractor.

(*A 25-pound bag sample of the plant mixture and companion set of three pavement cores shall be considered as one sample.)

2.7.2 Control Testing

Listed below are the minimum number and types of field tests required for job control. The frequency of tests will be increased as ordered by the Contracting Officer in the event proper control of the bituminous plant and placing operation are not being maintained with the minimum number of tests specified.

| Type of Test | Number of Tests |
|---|---|
| Stability, flow, unit weight, percent voids, total mix, and | Determine from set of three Marshall* specimens prepared from each 4 hours |

| | |
|---|---|
| percent voids filled. | of plant operation |
| In-place density and thickness | From set (three sawed or cored samples) for each 4 hours of plant operation; one-half should be obtained at joints |

| Type of Test | Number of Tests |
|---|---|
| Extractions (D 2172) | 2 per day |
| Sieve analysis (C 136) | 1 per shipment |
| Percentage of fractured faces of aggregate | 1 per shipment |

(*Mechanical Marshall hammer may be used, provided it is periodically calibrated against the results obtained by the hand hammer.)

2.7.3 Additional Tests for Dryer-Drum Mixing Process

For a period of 2 days and within 1 hour of the start of the mixing operations, the Contractor shall sample and perform tests as follows in addition to the normal tests specified above.

One set of Marshall specimens
One 20-pound bag of mixture for extractions

## 3.0 QUALITY CONTROL

During construction an established system of quality control shall be maintained. To assure compliance with contract requirements and the maintenance of records of all materials, equipment and construction operations, quality control shall include but not be limited to the following:

Condition of existing surface
Gradation of aggregates
Percentage of fractured faces of aggregate
Mix design properties - Marshall tests complete
Safety requirements
Grade control
Preparation of bituminous mixes
Density and thickness of compacted mixture
Straightedge requirements
Test of plant mixtures
Determination of quantities
Correction of defective pavement

A copy of all records and test data required herein and the records of corrective action taken shall be furnished the Contracting Officer.

-- End of Section -

SECTION 02580

PAVEMENT MARKINGS

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 247 | (1981; Rev 1986) Glass Beads Used in Traffic Paint |
| AASHTO M 248 | (1991I) Ready-Mixed White and Yellow Traffic Paints |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM D 792 | (1991) Density and Specific Gravity (Relative Density) of Plastics by Displacement |
| ASTM D 4280 | 1995) Extended Life Type, Nonplowable, Prismatic, Raised,Retroreflective Pavement Markers |
| ASTM D 4505 | (1992) Preformed Plastic Pavement Marking Tape for Extended Service Life |
| ASTM E 28 | (1992) Softening Point by Ring-and-Ball Apparatus |

FEDERAL SPECIFICATIONS (FS)

| | |
|---|---|
| FS TT-B-1325 | (Rev C) Beads (Glass Spheres) Retro-Reflective (Metric) |
| FS TT-P-85 | (Rev E) Paint, Traffic and Airfield Marking, Solvent Base |
| FS TT-P-115 | (Rev F) Paint, Traffic (Highway, White and Yellow) |
| FS TT-P-1952 | (Rev D) Paint, Traffic and Airfield Marking, Waterborne (Metric) |

FEDERAL STANDARDS (FED-STD)

| | |
|---|---|
| FED-STD 313 | (Rev C) Material Safety Data Transportation Data and Disposal Data For Hazardous Materials Furnished to Government Activities |

## 1.2 UNIT PRICES

*Omitted*

## 1.3 SUBMITTALS

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

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

SD-01 Data

Equipment Lists; FIO

Lists of proposed equipment to be used in performance of construction work, including descriptive data, and notifications of proposed Contractor actions as specified in this section.

SD-06 Instructions

Mixing, Thinning and Application; FIO.

Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use. MSDS shall meet the requirements of FED-STD 313.

SD-09 Reports

Material Tests; FIO.

Certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

SD-13 Certificates

Volatile Organic Compound (VOC) Content; FIO.

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

## 1.4 DELIVERY AND STORAGE

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

## 1.5 EQUIPMENT

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways will display low speed traffic markings and traffic warning lights.

### 1.5.1 Paint Application Equipment

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 8 kilometers per hour (5 mph), and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. Equipment used for marking streets and highways shall be capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines or a combination of solid and intermittent lines using a maximum of two different colors of paint as specified. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with

requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to insure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

1.5.2 Thermoplastic Application Equipment

1.5.2.1 Thermoplastic Material

Thermoplastic material shall be applied to the primed pavement surface by spray techniques or by the extrusion method, wherein one side of the shaping die is the pavement and the other three sides are contained by, or are part of, suitable equipment for heating and controlling the flow of material. By either method, the markings shall be applied with equipment that is capable of providing continuous uniformity in the dimensions of the stripe.

1.5.2.2 Application Equipment

Application equipment shall provide continuous mixing and agitation of the material. Conveying parts of the equipment between the main material reservoir and the extrusion shoe or spray gun shall prevent accumulation and clogging. All parts of the equipment which come into contact with the material shall be easily accessible and exposable for cleaning and maintenance. All mixing and conveying parts up to and including the extrusion shoes and spray guns shall maintain the material at the required temperature with heat-transfer oil or electrical-element-controlled heat.

The application equipment shall be so constructed as to ensure continuous uniformity in the dimensions of the stripe. The applicator shall provide a means for cleanly cutting off stripe ends squarely and shall provide a method of applying "skiplines." The equipment shall be capable of applying varying widths of traffic markings.

The applicator shall be equipped with a drop-on type bead dispenser capable of uniformly dispensing reflective glass spheres at controlled rates of flow. The bead dispenser shall be automatically operated and shall begin flow prior to the flow of composition to assure that the strip is fully reflectorized.

1.5.2.3 Mobile and Maneuverable

Application equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc. The equipment used for the placement of thermoplastic pavement markings shall be of two general types: mobile applicator and portable applicator.

a. Mobile Application Equipment: The mobile applicator shall be defined as a truck-mounted, self-contained pavement marking machine that is capable of hot applying thermoplastic by either the extrusion or spray method. The unit shall be equipped to apply the thermoplastic marking material at temperatures exceeding 190 degrees C (375 degrees F), at widths varying from 75 to 300 mm (3 to 12 inches) and in thicknesses varying from 1.0 to 5.0 mm (0.020 to 0.190 inch) and shall have an automatic drop-on bead system. The mobile unit shall be capable of operating continuously and of installing a minimum of 6 kilometers (20,000 lineal feet) of longitudinal markings in a 8-hour day.

(1) The mobile unit shall be equipped with a melting kettle of such capacity as to hold a minimum of 2.7 metric tons (6,000 pounds) of molten thermoplastic material. The kettle shall be capable of heating the thermoplastic composition to temperatures of 195 to 220 degrees C (375 to 425 degrees F). The heating mechanism shall be by means of a thermostatically controlled heat transfer liquid. Heating of the composition by direct flame shall not be allowed. Oil and material temperature gauges shall be visible at both ends of the kettle. The mobile unit shall be equipped with a spray gun system. The spray system shall consist of a minimum of four spray guns, located two on each side of the truck, and shall be capable of marking simultaneous edgeline and centerline stripes. The spray system shall be surrounded (jacketed) with heating oil so as to maintain the molten thermoplastic at a temperature of 195 to 220 degrees C (375 to 425 degrees F); and shall be capable of spraying a stripe of 75 to 300 mm (3 to 12 inches) in width, and in thicknesses varying from 1.5 mm (0.055 inch) (0.055 inch) to 2.5 mm (0.095 inch), and of generally uniform cross section.

(2) The mobile unit shall be equipped with an electronic programmable line pattern control system. The control system shall be capable of applying skip or solid lines in any sequence, through any and all of the extrusion shoes, or the spray guns, and in programmable cycle lengths. In addition, the mobile unit shall be equipped with an automatic counting mechanism capable of recording the number of lineal meters (feet) of thermoplastic markings applied to the pavement surface with an accuracy of 0.5 percent.

b. Portable Application Equipment: The portable applicator shall be defined as hand-operated equipment, specifically designed for placing special markings such as crosswalks, stopbars, legends, arrows, and short lengths of lane, edge and centerlines. The portable applicator shall be capable of applying thermoplastic pavement markings by the extrusion method. It is intended that the portable applicator will be loaded with hot thermoplastic composition from the melting kettles on the mobile applicator. The portable applicator shall be equipped with all the necessary components, including a materials storage reservoir, bead dispenser, extrusion shoe, and heating accessories, so as to be capable of holding the molten thermoplastic at a temperature of 195 to 220 degrees C (375 to 425 degrees F), of extruding a line of 75 to 300 mm (3 to 12 inches) in width, and in thicknesses of not less than 3.0 mm (0.125 inch) nor more than 5.0 mm (0.190 inch) and of generally uniform cross section.

### 1.5.3 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION at all operating speeds of the applicator to which it is attached.

### 1.5.4 Preformed Tape Application Equipment

Mechanical application equipment shall be used for the placement of preformed marking tape. Mechanical application equipment shall be defined as a mobile pavement marking machine specifically designed for use in applying precoated, pressure-sensitive pavement marking tape of varying widths, up to 300 mm (12 inches). The applicator shall be equipped with rollers, or other suitable compactive device, to provide initial adhesion of the preformed, pressure-sensitive marking tape with the pavement surface. Additional hand-operated rollers shall be used as required to properly seat the thermoplastic tape.

### 1.5.5 Surface Preparation Equipment

#### 1.5.5.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 70.8 liters per sec (150 cfm) of air at a pressure of not less than 620 kPa (90 psi) at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

#### 1.5.5.2 Waterblast Equipment

The water pressure shall be specified at 17.9 MPa (2,600 psi) at 60 degrees C (140 degrees F) in order to adequately clean the surfaces to be marked.

### 1.5.6 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

## 1.6 HAND-OPERATED, PUSH-TYPE MACHINES

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces shall be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

# PART 2 PRODUCTS

## 2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for airfields shall conform to FS TT-P-85, color as selected. Paint for roads and streets shall conform to AASHTO M 248, color as selected. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

## 2.2 THERMOPLASTIC COMPOUNDS

The thermoplastic reflectorized pavement marking compound shall be extruded or sprayed in a molten state onto a primed pavement surface. Following a surface application of glass beads and upon cooling to normal pavement temperatures, the marking shall be an adherent reflectorized strip of the specified thickness and width that is capable of resisting deformation by traffic.

### 2.2.1 Composition Requirements

The binder component shall be formulated as a hydrocarbon resin. The pigment, beads and filler shall be uniformly dispersed in the binder resin. The thermoplastic composition shall be free from all skins, dirt, and foreign objects and shall comply with the following requirements:

| | Percent by Weight | |
|---|---|---|
| Component | White | Yellow |
| Binder | 17 min. | 17 min. |
| Titanium dioxide | 10 min. | - |
| Glass beads | 20 min. | 20 min. |
| Calcium carbonate & inert fillers | 49 max. | * |
| Yellow pigments | - | * |

*Amount and type of yellow pigment, calcium carbonate and inert fillers shall be at the option of the manufacturer, providing the other composition requirements of this specification are met.

2.2.2 Physical Properties

2.2.2.1 Color

The color shall be as indicated.

2.2.2.2 Drying Time

When installed at 20 degrees C (70 degrees F) and in thicknesses between 3 and 5 mm (1/8 and 3/16 inch), the composition shall be completely solid and shall show no damaging effect from traffic after curing 15 minutes.

2.2.2.3 Softening Point

The composition shall have a softening point of not less than 90 degrees C (194 degrees F) when tested in accordance with ASTM E 28.

2.2.2.4 Specific Gravity

The specific gravity of the composition shall be between 1.9 and 2.2 as determined in accordance with ASTM D 792.

2.2.3 Asphalt Concrete Primer

The primer for asphalt concrete pavements shall be a thermosetting adhesive with a solids content of pigment reinforced synthetic rubber and synthetic plastic resin dissolved and/or dispersed in a volatile organic solvent. The solids content shall not be less than 10 percent by weight at 20 degrees C (70 degrees F) and 60 percent relative humidity. A wet film thickness of 0.10 mm (0.005 inch) plus or minus 0.025 mm (0.001 inch), shall dry to a tack-free condition in less than 5 minutes.

2.2.4 Portland Cement Concrete Primer

The primer for portland cement concrete pavements shall be an epoxy resin primer. The primer shall be of the type recommended by the manufacturer of

the thermoplastic composition. Epoxy primers recommended by the manufacturer shall be approved by the Contracting Officer prior to use. Requests for approval shall be accompanied with technical data, instructions for use, and a 1 liter (1 quart) sample of the primer material.

## 2.3 PREFORMED TAPE

The preformed tape shall be an adherent reflectorized strip in accordance with ASTM D 4505 Type I or IV, Class optional.

## 2.4 RAISED REFLECTIVE MARKERS

Either metallic or nonmetallic markers of the button or prismatic reflector type may be used. Markers shall be of permanent colors as specified for pavement marking, and shall retain the color and brightness under the action of traffic. Button markers shall have a diameter of not less than 100 mm (4 inches), and shall be spaced not more than 12 meters (40 feet) apart on solid longitudinal lines. Broken centerline marker spacings shall be in segments of 3.5 meters (8 feet) with gaps of 457 mm (18 inches) between segments. Markers shall have rounded surfaces presenting a smooth contour to traffic and shall not project more than 19 mm (3/4 inch) above level of pavement. Pavement markers and adhesive epoxy shall conform to ASTM D 4280.

## 2.5 REFLECTIVE MEDIA

Reflective media for airfields shall conform to FS TT-B-1325, Type III. Reflective media for roads and streets shall conform to FS TT-B-1325, Type I, Gradation A, or AASHTO M 247, Type I.

## 2.6 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers by the Contractor in the presence of a representative of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved. Testing shall be performed in an approved independent laboratory. If materials are approved based on reports furnished by the Contractor, samples will be retained by the Government for possible future testing should the material appear defective during or after application.

# PART 3 EXECUTION

## 3.1 SURFACE PREPARATION

Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

### 3.1.1 Pretreatment for Early Painting

Where early painting is required on rigid pavements, a pretreatment with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride shall be applied to prepared pavement areas prior to painting.

### 3.1.2 Cleaning Existing Pavement Markings

In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings that are in good condition that interfere with or conflict with the newly applied marking patterns shall be removed. Deteriorated or obscured markings that are not misleading or confusing or interfere with the adhesion of the new marking material do not require removal. New preformed and thermoplastic pavement markings shall not be applied over existing preformed or thermoplastic markings. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

### 3.1.3 Cleaning Concrete Curing Compounds

On new portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, thermoplastic and preformed markings shall be applied no sooner than 24 hours after the blasting has been completed. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.

b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.

c. All remaining curing compound is intact; all loose and flaking material is removed.

d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

e. The surface to be marked is dry.

## 3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

### 3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 5 degrees C (40 degrees F) and less than 35 degrees C (95 degrees F). Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified herein. The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.1.1 Rate of Application

Reflective Markings: Pigmented binder shall be applied evenly to the pavement area to be coated at a rate of 10 plus or minus 0.5 square meter per liter (105 plus or minus 5 square feet per gallon). Glass spheres shall be applied uniformly to the wet paint on road and street pavement at a rate of 0.7 (6) plus or minus 0.06 kilograms (0.5 pounds) of glass spheres per liter (gallon) of paint.

Nonreflective Markings: Paint shall be applied evenly to the pavement surface to be coated at a rate of 10 plus or minus 0.5 square meter per liter (105 plus or minus 5 square feet per gallon).

3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.2.2 Thermoplastic Compounds

Thermoplastic pavement markings shall be placed upon dry pavement; surface dry only shall not be considered an acceptable condition. At the time of installation, the pavement surface temperature shall be a minimum of 5 degrees C (40 degrees F) and rising. Thermoplastics, as placed, shall be free from dirt or tint.

3.2.2.1 Longitudinal Markings

All centerline, skipline, edgeline, and other longitudinal type markings shall be applied with a mobile applicator. All special markings, crosswalks, stop bars, legends, arrows, and similar patterns shall be placed with a portable applicator, using the extrusion method.

3.2.2.2 Primer

After surface preparation has been completed the asphalt and/or concrete pavement surface shall be primed. The primer shall be applied with spray equipment. Primer materials shall be allowed to "set-up" prior to applying the thermoplastic composition. The asphalt concrete primer shall be allowed to dry to a tack-free condition, usually occurring in less than 10 minutes. The portland cement concrete primer shall be allowed to dry in accordance with the thermoplastic manufacturer's recommendations. To shorten the curing time of the epoxy resins an infrared heating device may be used on the concrete primer.

Asphalt Concrete Primer: Primer shall be applied to all asphalt concrete pavements at a wet film thickness of 0.10 mm (0.005 inch), plus or minus 0.025 mm (0.001 inch) 25-40 square meters per liter (265-400 square feet per gallon).

Portland Cement Concrete Primer: Primer shall be applied to all concrete pavements (including concrete bridge decks) at a wet film thickness of between 1.0 to 1.3 mm (0.04 to 0.05 inch) 30-40 square meters per liter (320-400 square feet per gallon).

3.2.2.3 Markings

After the primer has "set-up" the thermoplastic shall be applied at temperatures no lower than 190 degrees C (375 degrees F) nor higher than 220

degrees C (425 degrees F) at the point of deposition. Immediately after installation of the marking, drop-on glass spheres shall be mechanically applied such that the spheres are held by and imbedded in the surface of the molten material.

Extruded Markings: All extruded thermoplastic markings shall be applied at the specified width and at a thickness of not less than 3.0 mm (0.125 inch) nor more than 5.0 mm (0.190 inch).

Sprayed Markings: All sprayed thermoplastic markings shall be applied at the specified width and the thicknesses designated in the contract plans. If the plans do not specify a thickness, centerline markings shall be applied at a wet thickness of 2.0 mm (0.090 inch), (0.090 inch,) plus or minus 0.10 mm (0.005 inch), and edgeline markings at a wet thickness of 1.5 mm (0.60 inch), plus or minus 0.10 mm (0.005 inch).

Reflective Glass Spheres: Immediately following application, reflective glass spheres shall be dropped onto the molten thermoplastic marking at the rate of 1 kilogram (1 pound) per 2 square meters (20 square feet) of compound.

3.2.3 Preformed Tape

The pavement surface temperature shall be a minimum of 15 degrees C (60 degrees F) and the ambient temperature shall be a minimum of 15 degrees C (60 degrees F) and rising. The preformed markings shall be placed in accordance with the manufacturer's written instructions.

3.2.4 Raised Reflective Markers

Prefabricated markers shall be aligned carefully at the required spacing and permanently fixed in place by means of epoxy resin adhesives. To insure good bond, pavement in areas where markers will be set shall be thoroughly cleaned by sandblasting and use of compressed air prior to applying adhesive.

3.2.5 Reflective Media

Application of reflective media shall immediately follow application of pigmented binder. Drop-on application of glass spheres shall be accomplished to insure that reflective media is evenly distributed at the specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, operations shall be discontinued immediately until deficiency is corrected.

-- End of Section --

SECTION 02660

WATER DISTRIBUTION SYSTEM

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 (1994a) Carbon Structural Steel

ASTM A 53 (1993a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM D 1599 (1988) Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings

ASTM D 1784 (1992) Rigid Poly(Vinyl Chloride) (PVC)Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D 1785 (1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D 2241 (1993) Poly(Vinyl Chloride) (PVC)Pressure-Rated Pipe (SDR Series)

ASTM D 2464 (1993) Threaded Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2466 (1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D 2467 (1993) Socket-Type Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2564 (1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D 2657 (1990) Heat-Joining Polyolefin Pipe and Fittings

ASTM D 2774 (1972; R 1983) Underground Installation of Thermoplastic Pressure Piping

ASTM D 2855 (1993) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

ASTM D 2996 (1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin)Pipe

ASTM D 2997 (1990) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin)Pipe

ASTM D 3839 (1994a) Underground Installation of "Fiberglass"

(Glass-Fiber-Reinforced Thermosetting Resin) Pipe

ASTM F 477 (1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1 (1983; R 1992) Pipe Threads, General Purpose (Inch)

ASME B16.1 (1989) Cast Iron Pipe Flanges and Flanged Fittings

ASME B16.3 (1992) Malleable Iron Threaded Fittings, Classes 150 and 300

ASME B36.10M (1985; R 1994) Welded and Seamless Wrought Steel Pipe

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1015 (1993) Double Check Backflow Prevention Assembly

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300 (1992) Hypochlorites

AWWA B301 (1992) Liquid Chlorine

AWWA C104 (1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C110 (1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids

AWWA C111 (1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C115 (1988) Flanged Ductile-Iron Pipe with Threaded Flanges

AWWA C151 (1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

AWWA C153 (1994) Ductile-Iron Compact Fittings, 3 In. Through 16 In., for Water and Other Liquids

AWWA C200 (1991) Steel Water Pipe - 6 In. (150 mm) and Larger

AWWA C203 (1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

AWWA C205 (1989) Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. and Larger - Shop Applied

AWWA C207 (1994) Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In.

AWWA C208 (1983; C208a; R 1989) Dimensions for Fabricated Steel Water Pipe Fittings

AWWA C500 (1993) Gate Valves for Water and Sewerage Systems

AWWA C502 (1985) Dry-Barrel Fire Hydrants

AWWA C504 (1994) Rubber-Seated Butterfly Valves

AWWA C509 (1994) Resilient-Seated Gate Valves for Water and Sewerage Systems

AWWA C600 (1993) Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA C606 (1987) Grooved and Shouldered Joints

AWWA C651 (1992) Disinfecting Water Mains

AWWA C800 (1989) Underground Service Line Valves and Fittings

AWWA C900 (1989; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

AWWA C905 (1988) Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. Through 36 In.

AWWA C950 (1988) Fiberglass Pressure Pipe

AWWA M23 (1980) Manual: PVC Pipe - Design and Installation

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P7825 (1994, Supple I, II, and II) Approval Guide

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA-01 (1992; Errata May 1993) Thrust Restraint Design for Ductile Iron Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71 (1990) Cast Iron Swing Check Valves, Flanged and Threaded Ends

MSS SP-80 (1987) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24 (1992) Installation of Private Fire Service Mains and Their Appurtenances

NFPA 49 (1991) Hazardous Chemicals Data

NFPA 325M (1991) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids

NFPA 704 (1990) Identification of the Fire Hazards of Materials

NSF INTERNATIONAL (NSF)

NSF Std 14 (1965; Rev Nov 1990) Plastics Piping System Components and Related Materials

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 21 (1991) White or Colored Silicone Alkyd Paint

SSPC Paint 25 (1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)

UNDERWRITER'S LABORATORIES (UL)

UL 04 (1994; Supple) Fire Protection Equipment Directory

1.2 PIPING

This section covers water service lines, and connections to building service at a point approximately 1.5 m outside buildings and structures to which service is required. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

1.2.1 Service Lines

Piping for water service lines for sizes 80 mm and larger shall be ductile iron, polyvinyl chloride (PVC) plastic through 300 mm nominal diameter, filament-wound or centrifugally cast reinforced thermosetting resin, reinforced plastic mortar pressure pipe or steel, unless otherwise shown or specified.

1.2.2 Omitted
1.2.3 Omitted

1.2.4 Sprinkler Supply Lines

Piping for water lines supplying sprinkler systems for building fire protection shall conform to NFPA 24 from the point of connection with the water distribution system to the building 1.5 m line.

1.2.5 Plastic Pipe

All plastic piping system components (PVC, polyethylene, thermosetting resin and reinforced plastic mortar pressure) intended for transportation of potable water shall comply with NSF Std 14 and shall be legibly marked with their symbol.

1.2.6 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

## 1.3 UNIT PRICES

Measurement and payment will be based on completed work performed in accordance with the drawings, specifications, and the contract payment schedules. No payment will be made under this section for excavation, trenching, or backfilling. Payment for such work will be made under Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 1.3.1 Measurement

The length of water lines to be paid for will be determined by measuring along the centerlines of the various sizes of pipe furnished and installed. Pipe will be measured from center of fitting to center of fitting, from center of water distribution line to end of service connection, and from center of water distribution line to center of hydrant. No deduction will be made for the space occupied by valves or fittings.

### 1.3.2 Payment

Payment will be made for water lines at the contract unit price per linear foot for the various types and sizes of water lines, and shall be full compensation for all pipes, joints, specials, and fittings, complete in place. Payment for fire hydrants, gate valves, valve boxes, and standard valve manholes will be made at the respective contract unit price each for such items complete in place. Payment will include the furnishing of all testing, plant, labor, and material and incidentals necessary to complete the work, as specified and as shown.

## 1.4 MANUFACTURER'S REPRESENTATIVE

The Contractor shall negotiate to have a manufacturer's field representative present at the jobsite during the installation and testing of PE, RTRP, and/or RPMP pipe to provide technical assistance and to verify that the materials are being installed in accordance with the manufacturer's prescribed procedures. When the representative feels that the Contractor is installing and testing the PE, RTRP, and/or RPMP pipe in a satisfactory manner, certification shall be written to note which individuals employed by the Contractor are capable of properly installing the pipe. The field representative shall advise the Contractor of unsatisfactory conditions immediately when they occur. Such conditions include improper diameter of pipe ends, damaged interior liner, poorly prepared joints, improper curing of joints, moving pipe before joints are cured, bending pipe to follow abrupt changes in trench contours, leaving pipe ends open in trench overnight, not properly drying joints after rain storms, exceeding effective adhesive life, sharp objects in trench bed, backfill that could damage pipe, improper procedure for concrete encasement of pipe, omission of thrust blocks at changes in direction or any other conditions which could have an adverse effect on the satisfactory completion and operation of the piping system.

## 1.5 SUBMITTALS

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

SD-06 Instructions

Installation; FIO.

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

SD-08 Statements

Waste Water Disposal Method; FIO.

The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.

Satisfactory Installation; FIO.

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

SD-09 Reports

Bacteriological Disinfection; FIO.

Test results from commercial laboratory verifying disinfection.

SD-13 Certificates

Manufacturer's Representative; FIO.

The name and qualifications of the manufacturer's representative and written certification from the manufacturer that the representative is technically qualified in all phases of PE, RTRP, and/or RPMP pipe laying and jointing and experienced to supervise the work and train the Contractor's field installers, prior to commencing installation.

Installation; FIO.

A statement signed by the manufacturer's field representative certifying that the Contractor's personnel are capable of properly installing the pipe on the project.

1.6 HANDLING

Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without

additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

1.6.1 Coated and Wrapped Steel Pipe

Coated and wrapped steel pipe shall be handled in conformance with AWWA C203.

1.6.2 Omitted

1.6.3 Miscellaneous Plastic Pipe and Fittings

Polyvinyl Chloride (PVC), Reinforced Thermosetting Resin Pipe (RTRP), and Reinforced Plastic Mortar Pressure (RPMP) pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below. Pipe used for sprinkler supply lines shall be listed in UL-04 or FM P7825, and shall meet the requirements of NFPA 24.

2.1.1 Omitted

2.1.2 Plastic Pipe

2.1.2.1 Omitted

2.1.2.2 Polyvinyl Chloride (PVC) Plastic Pipe

Pipe, couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B.

a. Omitted

b. Pipe 100 mm through 300 mm Diameter: Pipe, couplings and fittings shall conform to AWWA C900, Class 150, CIOD pipe dimensions, elastomeric-gasket joint, unless otherwise shown or specified.

2.1.3 Reinforced Plastic Mortar Pressure (RPMP) Pipe

AWWA C950.

2.1.4 Reinforced Thermosetting Resin Pipe (RTRP)

Pipe shall have a quick-burst strength greater than or equal to four times the normal working pressure of the pipe. The quick-burst strength test shall conform to the requirements of ASTM D 1599.

2.1.4.1 RTRP-I

RTRP-I shall conform to ASTM D 2996, except pipe shall have an outside diameter equal to cast iron outside diameter or standard weight steel pipe. The pipe shall be suitable for a normal working pressure of 1.03 MPa (150 psi) at 23 degrees C (73 degrees F). The inner surface of the pipe shall have a smooth uniform continuous resin-rich surface liner conforming to ASTM D 2996.

2.1.4.2 RTRP-II

RTRP-II shall conform to ASTM D 2997. Pipe shall have an outside diameter equal to standard weight steel pipe.

2.1.5 Ductile-Iron Pipe

Ductile-iron pipe shall conform to AWWA C151, working pressure not less than 1.03 MPa (150 psi), unless otherwise shown or specified. Pipe shall be cement-mortar lined in accordance with AWWA C104. Linings shall be standard. Flanged ductile iron pipe with threaded flanges shall be in accordance with AWWA C115.

2.1.6 Steel Pipe

2.1.6.1 Omitted

2.1.6.2 Galvanized-Steel Pipe

Galvanized-steel pipe shall conform to ASTM A 53, standard weight.

2.1.6.3 Omitted
2.1.7 Omitted

2.2 FITTINGS AND SPECIALS

2.2.1 Omitted

2.2.2 Polyvinyl Chloride (PVC) Pipe

a. Omitted

b. For pipe 100 mm diameter and larger, fittings and specials shall be iron, bell end in accordance with AWWA C110, 1.03 MPa (150 psi) pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or may be fittings and specials of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA C900. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Fittings shall be bell and spigot or plain end pipe, or as applicable. Ductile iron compact fittings shall be in accordance with AWWA C153.

2.2.3 RTRP and RPMP Pipe

Fittings and specials shall be compatible with the pipe supplied. Filament wound or molded fittings up to 150 mm shall conform to AWWA C950. Iron fittings shall be cement-mortar lined in accordance with AWWA C104 and shall conform to AWWA C110 and AWWA C111. Fittings shall be suitable for working and testing pressures specified for the pipe.

2.2.4 Ductile-Iron Pipe

Fittings and special shall be suitable for 1.03 MPa (150 psi) pressure rating, unless otherwise specified. Fittings and specials for mechanical joint pipe shall conform to AWWA C110. Fittings and specials for use with push-on joint pipe shall conform to AWWA C110 and AWWA C111. Fittings and specials for grooved and shouldered end pipe shall conform to AWWA C606. Fittings and specials shall be cement-mortar lined (standard thickness) in accordance with

AWWA C104. Ductile iron compact fittings shall conform to AWWA C153.

2.2.5 Steel Pipe

2.2.5.1 Omitted

2.2.5.2 Galvanized-Steel Pipe

Steel fittings shall be galvanized. Screwed fittings shall conform to ASME B16.3. Flanged fittings shall conform to AWWA C207.

2.2.5.3 Dielectric Fittings

Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

2.3 JOINTS

2.3.1 Omitted

2.3.2 Plastic Pipe

2.3.2.1 Omitted

2.3.2.2 Polyvinyl Chloride Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations as approved by the Contracting Officer.

2.3.3 RPMP Pipe

Joints shall be mechanical or bell and spigot type with elastomeric gasket.

2.3.4 RTRP

2.3.4.1 RTRP-I, Grade I and 2

Joints shall be bell and spigot with elastomeric gasket, mechanical coupling with elastomeric gasket, threaded and bonded coupling, or tapered bell and spigot with compatible adhesive. All RTRP-I materials shall be products of a single manufacturer.

2.3.4.2 RTRP-II, Grade 1 and 2

Joints shall be the bell and spigot type with elastomeric gasket, bell and spigot with adhesive, butt-jointed with adhesive bonded reinforced overlay, mechanical, flanged, threaded or commercially available proprietary joints, provided they are capable of conveying water at the pressure and temperature of the pipe.

2.3.5 Ductile-Iron Pipe

a. Mechanical joints shall be of the stuffing box type and shall conform to AWWA C111.

b. Push-on joints shall conform to AWWA C111.

c. Rubber gaskets and lubricant shall conform to the applicable requirements of AWWA C111.

2.3.6 Steel Pipe

2.3.6.1 Omitted

2.3.6.2 Mechanical Couplings

Mechanical couplings for steel pipe shall be the sleeve type, or when approved, the split-sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movements caused by expansion, contraction, slight setting or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Couplings shall be of strength not less than the adjoining pipeline.

2.3.7 Omitted

2.3.8 Isolation Joints

Isolation joints shall be installed between nonthreaded ferrous and nonferrous metallic pipe, fittings and valves. Isolation joints shall consist of a sandwich-type flange isolation gasket of the dielectric type, isolation washers, and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

a. Sleeve-type couplings shall be used for joining plain end pipe sections. The two couplings shall consist of one steel middle ring, two steel followers, two gaskets, and the necessary steel bolts and nuts to compress the gaskets.

b. Split-sleeve type couplings may be used in aboveground installations when approved in special situations and shall consist of gaskets and a housing in two or more sections with the necessary bolts and nuts.

2.4 VALVES

2.4.1 Check Valves

Check valves shall be designed for a minimum working pressure of 1.03 MPa (150 psi) or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve. Valves 50 mm and larger shall be swing type.

a. Omitted

b. Valves larger than 50 mm shall be iron body, bronze mounted, shall have flanged ends, and shall be the non-slam type. Flanges shall be the Class 125 type conforming to ASME B16.1.

c. Valves in sprinkler supply lines shall be listed in UL-04 or FM P7825.

Valves 100mm 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.

2.4.2 Gate Valves

Gate valves shall be designed for a working pressure of not less than 1.03 MPa (150 psi). Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

a. Omitted

b. Valves 80 mm and larger shall be iron body, bronze mounted, and shall conform to AWWA C500. Flanges shall not be buried. An approved pit shall be provided for all flanged connections.

c. Resilient-Seated Gate Valves: For valves 80 to 300 mm in size, resilient-seated gate valves shall conform to AWWA C509.

d. Valves in sprinkler supply lines shall be listed in UL-04 or FM P7825.

2.4.3 Rubber-Seated Butterfly Valves

Rubber-seated butterfly valves shall conform to the performance requirements of AWWA C504. Wafer type valves conforming to the performance requirements of AWWA C504 in all respects, but not meeting laying length requirements will be acceptable if supplied and installed with a spacer providing the specified laying length. All tests required by AWWA C504 shall be met. Flanged-end valves shall be installed in an approved pit and provided with a union or sleeve-type coupling in the pit to permit removal. Mechanical-end valves 80 mm through 250 mm in diameter may be direct burial if provided with a suitable valve box, means for manual operation, and an adjacent pipe joint to facilitate valve removal. Valve operators shall restrict closing to a rate requiring approximately 60 seconds, from fully open to fully closed.

2.4.4 Omitted
2.4.5 Omitted

2.4.6 Indicator Post for Valves

Each valve shown on the drawings with the designation "P.I.V." shall be equipped with indicator post conforming to the requirements of NFPA 24. Operation shall be by a wrench which will be attached to each post.

2.5 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 5 mm. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

2.6 VALVE PITS

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown. Concrete shall have compressive strength of 21 MPa (3,000 psi) in accordance with Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

## 2.7 FIRE HYDRANTS

Hydrants shall be dry-barrel type conforming to AWWA C502 with valve opening at least 125 mm in diameter and designed so that the flange at the main valve seat can be removed with the main valve seat apparatus remaining intact, closed and reasonably tight against leakage and with a breakable valve rod coupling and breakable flange connections located no more than 200 mm above the ground grade. Hydrants shall have a 150 mm bell connection, two 65 mm hose connections and one 115 mm pumper connection. Outlets shall have American National Standard fire-hose coupling threads. Working parts shall be bronze. Design, material, and workmanship shall be similar and equal to the latest stock pattern ordinarily produced by the manufacturer. Hydrants shall be painted with one coat of red iron oxide, zinc oxide primer conforming to SSPC Paint 25 and two finish coats of silicone alkyd paint conforming to SSPC Paint 21, of the installation's standard colors or as directed by the Contracting Officer. Suitable bronze adapter for each outlet, with caps, shall be furnished.

## 2.8 OMITTED

## 2.9 MISCELLANEOUS ITEMS

### 2.9.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

### 2.9.2 Omitted

### 2.9.3 Omitted

### 2.9.4 Service Stops

Service stops shall be water-works inverted-ground-key type, oval or round flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. All parts shall be of bronze with female iron-pipe-size connections or compression-pattern flared tube couplings, and shall be designed for a hydrostatic test pressure not less than 1.375 MPa (200 psi).

### 2.9.5 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable-iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 1.03 MPa (150psi). Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower

housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 67.8 Newton meters.

2.9.6 Service Boxes

Service boxes shall be cast iron or concrete and shall be extension service boxes of the length required for the depth of the line, with either screw or slide-type adjustment. The boxes shall have housings of sufficient size to completely cover the service stop or valve and shall be complete with identifying covers.

2.9.7 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

2.9.8 Omitted
2.9.9 Omitted

2.10 VAULTS

Backflow preventers shall be installed in reinforced concrete vaults in accordance with the details shown on the drawings.

2.11 DOUBLE-CHECK VALVE BACKFLOW PREVENTION ASSEMBLIES

a. Double-check backflow prevention assembly for fire service lines 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 1.03 MPa. The maximum pressure loss shall be 40 kPa at a flow rate equal to the sprinkler water demand, at the location of the assembly.

b. Double-check backflow preventers for domestic service lines shall be approved and listed by the Foundation for Cross-Connection Control & Hydraulic Research. Double-check valve assemblies shall be tested, approved, and listed in accordance with FCCHR-01.

3.1 INSTALLATION

3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Squeeze type mechanical cutters shall not be used for ductile iron.

3.1.2 Adjacent Facilities

3.1.2.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 3 m from a sewer except where the bottom of the water pipe will be at least 300 mm above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 1.8 m from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 3 m each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 900 mm horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 600 mm above the sewer main. Joints in the sewer main, closer horizontally than 900 mm to the crossing, shall be encased in concrete.

3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

3.1.2.3 Copper Tubing

Copper tubing shall not be installed in the same trench with ferrous piping materials.

3.1.2.4 Nonferrous Metallic Pipe

Where nonferrous metallic pipe, e.g. copper tubing, crosses any ferrous piping material, a minimum vertical separation of 300 mm shall be maintained between pipes.

3.1.3 Joint Deflection

3.1.3.1 Omitted

3.1.3.2 Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but in no case shall it exceed 5 degrees.

3.1.3.3 Ductile-Iron Pipe

The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

3.1.3.4 Steel Pipe

For pipe with bell-and-spigot rubber-gasket joints, maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets shall be 5 degrees unless a lesser amount is recommended by the manufacturer. Short-radius curves and closures shall be formed by short lengths of pipe or fabricated specials specified.

3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Under no

circumstances shall any of the water-line materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

3.1.4.1 Omitted

3.1.4.2 Plastic Pipe Installation

RTRP shall be installed in accordance with ASTM D 3839. RPMP shall be installed in accordance with the recommendations of the manufacturer. PE Pipe shall be installed in accordance with ASTM D 2774. PVC pipe shall be installed in accordance with AWWA M23.

3.1.4.3 Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA-01.

3.1.4.4 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

3.1.4.5 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

3.1.5 Jointing

3.1.5.1 Omitted
3.1.5.2 Omitted

3.1.5.3 Polyvinyl Chloride (PVC) Plastic Pipe

a. Omitted

b. Pipe 100 mm through 300 mm diameter: Joints shall be elastomeric-gasket as specified in AWWA C900. Jointing procedure shall be as specified for pipe less than 100 mm diameter with configuration using elastomeric ring gasket.

3.1.5.4 RTRP I, RTRP II and RPMP Pipe

a. RTRP I: Assembly of the pipe shall be done in strict conformance with the manufacturer's written instruction and installation procedures. Field joints shall be prepared as specified by the pipe manufacturer. Several pipe joints having interference-fit type couplings may be field bonded and cured simultaneously. However, the pipe shall not be moved nor shall additional joints be made until the previously laid joints are completely cured. Joints not having interference-fit type coupling shall be fitted with a clamp which shall hold the joint rigidly in place until the joint cement has completely cured. The clamps shall have a protective material on the inner surface to prevent damage to the plastic pipe when the clamp is tightened in place. The pipe manufacturer shall provide a device or method to determine when the joint is pulled against the pipe stop. Additionally, the pipe manufacturer shall furnish a gauge to measure the diameter of the spigot ends to ensure the diameter conforms to the tolerances specified by the manufacturer. All pipe ends shall be gauged. Factory certified tests shall have been satisfactorily performed to verify that short-term rupture strength is 10.3 MPa (1,500 psi) or greater when carried out in accordance with ASTM D 1599. All field bonded epoxy-cemented joints, regardless of ambient temperature, shall be cured with a self-regulating thermostatically temperature controlled electrical heating blanket for the time and temperature recommended by the manufacturer for the applicable size and type of joint, or by an alternate heating method recommended by the manufacturer and approved by the Contracting Officer. The joint sections shall not be moved during heating or until the joint has cooled to ambient temperature.

b. RTRP II: A reinforced overlay joint shall be used to join sections together through a placement of layers of reinforcement fiberglass roving, mat, tape or fabric thoroughly saturated with compatible catalyzed resin.

c. Fittings and Specials for RTRP and RPMP Pipe: Metal to RTRP and RPMP pipe connections shall be made by bolting steel flanges to RTRP and RPMP pipe flanges. Cast-iron fitting with gasket bell or mechanical joint may be used with RTRP if pipe has cast iron outside diameter. Steel flanges shall be flat-faced type. Where raised-face steel flanges are used, spacer rings shall be used to provide a flat-face seat for RTRP and RPMP pipe flanges. A full-face Buna "N" gasket 3.2 mm thick with a shore hardness of 50-60 shall be used between all flanged connections. The RTRP and RPMP pipe flange shall have raised sealing rings. Flat washers shall be used under all nuts and bolts on RTRP and RPMP pipe flanges. Bolts and nuts shall be of noncorrosive steel and torqued to not more than 135 Newton meters. Flanges shall not be buried. A concrete pit shall be provided for all flanged connections.

3.1.5.5 Ductile-Iron Pipe

Mechanical and push-on type joints shall be installed in accordance with AWWA C600 for buried lines or AWWA C606 for grooved and shouldered pipe above ground or in pits.

3.1.5.6 Omitted

3.1.5.7 Galvanized-Steel Pipe

Screw joints shall be made tight with a stiff mixture of graphite and oil, inert filler and oil, or with an approved graphite compound, applied with a brush to the male threads only. Compounds shall not contain lead.

3.1.5.8 Omitted

3.1.5.9 Bonded Joints

Bonded joints shall be installed in accordance with details specified for joints in paragraph JOINTS.

3.1.5.10 Isolation Joints and Dielectric Fittings

Isolation joints and dielectric fittings shall be installed in accordance with details specified in paragraph JOINTS. Dielectric unions shall be encapsulated in a field-poured coal-tar covering, with at least 3 mm thickness of coal tar over all fitting surfaces.

3.1.5.11 Connections

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

3.1.6 Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point approximately 1.5 m outside the building where such building service exists. Where building services are not installed, the Contractor shall terminate the service lines approximately 1.5 m from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes. Service lines shall be constructed in accordance with the following requirements:

3.1.6.1 Omitted
3.1.6.2 Omitted
3.1.6.3 Omitted

3.1.6.4 Service Lines Larger than 50 mm

Service lines larger than 50 mm shall be connected to the main by a tapped saddle, tapping sleeve and valve, service clamp or reducing tee, depending on the main diameter and the service line diameter, and shall have a gate valve. Lines 80 mm and larger may use rubber-seated butterfly valves as specified above, or gate valves.

3.1.6.5 Service Lines for Sprinkler Supplies

Water service lines used to supply building sprinkler systems for fire protection shall be connected to the water distribution main in accordance with NFPA 24.

3.1.7 Omitted

3.1.7.1 Omitted

3.1.7.2 Galvanized-Steel Pipe

Field joints shall be given one coat of coal-tar primer and two coats of coal-tar enamel conforming to AWWA C203. The tests of the coating shall conform to AWWA C203, and any flaws or holidays found in the coating of pipe

and joints shall be repaired by patching or other approved means such that the repaired areas will be at least equal in thickness to the minimum coating required for the pipe.

3.1.8 Setting of Fire Hydrants, Backflow Preventers, Valves and Valve Boxes

3.1.8.1 Fire Hydrants

Fire hydrants shall be located and installed as shown. Each hydrant shall be connected to the main with a 150 mm branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the roadway, with the center of the lowest outlet not less than 450 mm above the finished surrounding grade, and the operating nut not more than 1.2 m above the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished gradeline immediately after installation to obtain beneficial use of the hydrant as soon as practicable. The hydrant shall be set upon a slab of concrete not less than 100 mm thick and 400 mm square. Not less than 2 cubic meters of free-draining broken stone or gravel shall be placed around and beneath the waste opening of dry barrel hydrants to ensure drainage.

3.1.8.2 Backflow Preventers

Vaults shall be installed at the locations shown on the drawings. The meters shall be centered in the vaults to allow for reading and ease of removal or maintenance.

3.1.8.3 Valves

After delivery, valves, including those in hydrants, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and hydrants and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Check, pressure reducing, vacuum, and air relief valves shall be installed in valve pits. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be carefully tamped around each valve box or pit to a distance of 1.2 m on all sides of the box, or the undisturbed trench face if less than 1.2 m.

3.1.8.4 Service Boxes

Where water lines are located below paved streets having curbs, the boxes shall be installed directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

3.1.9 Omitted

3.1.10 Thrust Restraint

Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, on waterlines 100 mm in diameter or larger, and fire hydrants shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for

ductile-iron pipes, restrained joints.

3.1.10.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 14 MPa (2,000 psi) after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.10.2 Restrained Joints

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

3.2 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fitting or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved.

3.2.1 Pressure Test

After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 1.38 MPa (200 psi). Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves, discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

a. Wet or unstable soil conditions in the trench.

b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.

c. Maintaining the trench in an open condition would delay completion of the contract.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02222 EXCAVATION,

TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

3.2.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 1.38 MPa (200 psi). Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain pressure within 34.5 kPa (5 psi) of the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

L = 0.0001351ND(P raised to 1/2 power)

L = Allowable leakage in gallons per hour
N = Number of joints in the length of pipeline tested
D = Nominal diameter of the pipe in inches
P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

3.2.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

3.2.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be satisfactory as specified. All replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

a. Pressure test and leakage test may be conducted concurrently.

b. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

3.3 DISINFECTION

3.3.1 Bacteriological Disinfection

Before acceptance of potable water operation, each unit of completed waterline

shall be disinfected as prescribed by AWWA C651. From several points in the unit, personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with state approved methods. The commercial laboratory must be certified by the state's approving authority for examination of potable water. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

3.3.2 Lead Residual

Following the bacteriological disinfection and testing, the system shall be flushed with a sufficient velocity of water and sufficient tests performed at each hot- and cold-water discharge point until no more than 15 ppb lead residuals remain in the system. All tests and samples shall be performed in accordance with state and, if applicable, Federal regulations. Samples for testing are to be collected after a 6-hour continuous period of no flushing, and will be considered first draw samples. The commercial laboratory must be certified by the state's approving authority for examination of potable water. Lead residual test results are to be submitted to the Contracting Officer. The system will not be accepted until satisfactory bacteriological results and lead residual test results have been obtained. All flushing and testing for lead residuals, including all costs, are the responsibility of the Contractor.

3.4 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION 02685

GAS DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

| | |
|---|---|
| ANSI B109.2 | (1992) Diaphragm Type Gas Displacement Meters (Over 500 Cubic Feet per Hour Capacity) |

AMERICAN PETROLEUM INSTITUTE (API)

| | |
|---|---|
| API Spec 5L | (1995) Line Pipe |
| API Spec 6D | (1994; Supple June 1996) Pipeline Valves, (Gate, Plug, Ball, and Check Valves) |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 53 | (1996) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless |
| ASTM A 181 | (1995b) Forgings, Carbon Steel, for General-Purpose Piping |
| ASTM D 3308 | (1991a) PTFE Resin Skived Tape |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|---|---|
| ASME B1.20.1 | (1983; R 1992) Pipe Threads, General Purpose (Inch) |
| ASME B16.5 | (1988; Errata Oct 1988; B16.5a) Pipe Flanges and Flanged Fittings |
| ASME B16.9 | (1993) Factory-Made Wrought Steel Buttwelding Fittings |
| ASME B16.11 | (1991) Forged Fittings, Socket-Welding and Threaded |
| ASME B16.21 | (1992) Nonmetallic Flat Gaskets for Pipe Flanges |
| ASME B16.34 | (1988) Valves - Flanged, Threaded, and Welding End |

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

CODE OF FEDERAL REGULATIONS (CFR)

| | |
|---|---|
| 49 CFR 192 | Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards |

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

| | |
|---|---|
| MSS SP-25 | (1993) Standard Marking System for Valves, Fittings, Flanges and Unions |

NACE INTERNATIONAL (NACE)

| | |
|---|---|
| NACE RP0185 | (1985) Extruded, Polyolefin Resin Coating Systems for Underground or Submerged Pipe |
| NACE RP0274 | (1993) High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation |

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

| | |
|---|---|
| SSPC Paint 25 | (1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments) |
| SSPC Paint 104 | (1991) White or Tinted Alkyd Paint |
| SSPC SP 1 | (1982) Solvent Cleaning |
| SSPC SP 6 | (1994) Commercial Blast Cleaning |
| SSPC SP 7 | (1994) Brush-Off Blast Cleaning |

UNDERWRITERS LABORATORIES (UL)

| | |
|---|---|
| UL-06 | (1996) Gas and Oil Equipment Directory |

## 1.2 GENERAL REQUIREMENTS

### 1.2.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Asbestos or products containing asbestos shall not be used. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Valves, flanges, and fittings shall be marked in accordance with MSS SP-25.

### 1.2.2 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.2.3 Handling

Pipe and components shall be handled carefully to ensure a sound, undamaged condition. Particular care shall be taken not to damage pipe coating. No pipe or material of any kind shall be placed inside another pipe or fitting after the coating has been applied, except as specified in paragraph INSTALLATION. Plastic pipe shall be handled in conformance with AGA-01.

1.3 SUBMITTALS

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

SD-04 Drawings

Pipe, Fittings, and Associated Materials; FIO.

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

SD-07 Schedules

Equipment and Materials; FIO.

A complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions, including, but not limited to the following:

a. Dielectric Unions and Flange Kits.
b. Meters.
c. Pressure Reducing Valves.
d. Regulators.
e. Emergency Gas Supply Connection.

Spare Parts Data; FIO.

Spare parts lists for each different item of material and equipment specified, after approval of the detail drawings and not later than 1 month prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

Notification; FIO.

Notification of the Contractor's schedule for making connections to existing gas lines, at least 10 days in advance.

SD-08 Statements

Welding Steel Piping; FIO.

A copy of qualified welding procedures along with a list of names and identification symbols of performance qualified welders and welding operators.

Connection and Abandonment Procedures; GA.

A copy of procedures for gas line tie in, hot taps, abandonment/removal or demolition, purging, and plugging as applicable in accordance with ASME B31.8.

SD-13 Certificates

Utility Work; FIO.

Certification from the Operating Agency/Utility Company that work for which the Utility is responsible has been completed.

Training; FIO.

A copy of each inspector's and jointer's training certificate with respective test results.

SD-19 Operation and Maintenance Manuals

Gas Distribution System; FIO.

Six copies, in booklet form and indexed, of site specific natural gas operation and maintenance manual for each gas distribution system including system operation, system maintenance, equipment operation, and equipment maintenance manuals described below. If operation and maintenance manuals are provided in a common volume, they shall be clearly differentiated and separately indexed.

The System Operation Manual shall include but not be limited to the following:

a. Maps showing piping layout and locations of all system valves and gas line markers.
b. Step-by-step procedures required for system startup, operation, and shutdown. System components and equipment shall be indexed to the gas maps.
c. Isolation procedures and valve operations to shut down or isolate each section of the system. Valves and other system components shall be indexed to the gas maps.
d. Descriptions of Site Specific Standard Operation Procedures including permanent and temporary pipe repair procedures, system restart and test procedures for placing repaired lines back in service, and procedures for abandoning gas piping and system components.
e. Descriptions of Emergency Procedures including: isolation procedures including required valve operations with valve locations indexed to gas map, recommended emergency equipment, checklist for major emergencies and procedures for connecting emergency gas supply.

The Equipment Operation Manual shall include but not be limited to detail drawings, equipment data, and manufacturer supplied operation manuals for all equipment, valves and system components.

The System Maintenance Manuals shall include but not be limited to:

a. Maintenance check list for entire gas distribution system.
b. Descriptions of site specific standard maintenance procedures.
c. Maintenance procedures for installed cathodic protection systems.
d. Piping layout, equipment layout, and control diagrams of the

systems as installed.
e. Identification of pipe materials and manufacturer by location, pipe repair procedures, and jointing procedures at transitions to other piping materials or piping from different manufacturer.

The Equipment Maintenance Manuals shall include but not be limited to the following:

a. Identification of valves and other equipment by materials, manufacturer, vendor identification and location.
b. Maintenance procedures and recommended maintenance tool kits for all valves and equipment.
c. Recommended repair methods, either field repair, factory repair, or whole-item replacement for each valve component or piece of equipment or component item.
d. Routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide.

PART 2 PRODUCTS

2.1 PIPE, FITTINGS, AND ASSOCIATED MATERIALS

2.1.1 Steel Pipe

Steel pipe shall conform to ASTM A 53, Grade A or B, Type E or S, Schedule 40; or API Spec 5L seamless or electric resistance welded, Schedule 40, black steel pipe as specified in ASME B31.8. Furnace buttwelded pipe may be used in sizes 40 mm and smaller.

2.1.2 Small Fittings

Fittings 40 mm and smaller shall conform to ASME B16.11.

2.1.3 Fittings, 50 mm and Larger

Pipe flanges and flanged fittings including bolts, nuts, and bolt patterns shall be in accordance with ASME B16.5, Class 150. Buttweld fittings shall be in accordance with ASME B16.9. Weld neck flanges shall be used.

2.1.4 Steel Forged Branch Connections

Connections shall conform to ASTM A 181, Class 60, carbon steel.

2.1.5 Flange Gaskets

Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm minimum thickness, full face or self-centering flat ring type. The gaskets shall contain aramid fibers bonded with nitrile butadiene rubber (NBR), or glass fibers bonded with polytetrafluorethylene, suitable for maximum 315 degrees C (600 degrees F) service and meeting applicable requirements of ASME B31.8.

2.1.6 Pipe Threads

Pipe threads shall conform to ASME B1.20.1.

2.1.9 Sealants for Steel Pipe Threaded Joints

2.1.9.1 Sealing Compound

Joint sealing compound shall be as listed in UL-06, Class 20 or less.

2.1.9.2 Tape

Polytetrafluoroethylene tape shall conform to ASTM D 3308.

2.1.10 Identification

Pipe flow markings and metal tags for each valve, meter, and regulator shall be provided as required by the Contracting Officer.

2.1.11 Insulating Joint Materials

Insulating joint materials shall be provided between flanged or threaded metallic pipe systems where shown to isolate galvanic or electrolytic action.

2.1.11.1 Threaded Joints

Joints for threaded pipe shall be steel body nut type dielectric type unions with insulating gaskets.

2.1.11.2 Flanged Joints

Joints for flanged pipe shall consist of full face sandwich-type flange insulating gasket of the dielectric type, insulating sleeves for flange bolts and insulating washers for flange nuts.

2.2 VALVES

Valves shall be suitable for shutoff or isolation service and shall conform to the following:

2.2.1 Steel Valves

Steel valves 40 mm and smaller installed underground shall conform to ASME B16.34, carbon steel, socket weld ends, with square wrench operator adaptor. Steel valves 40 mm and smaller installed aboveground shall conform to ASME B16.34, carbon steel, socket weld or threaded ends with handwheel or wrench operator. Steel valves 50 mm and larger installed underground shall conform to API Spec 6D, carbon steel, buttweld ends, Class 150 with square wrench operator adaptor. Steel valves 50 mm and larger installed aboveground shall conform to API Spec 6D, carbon steel, buttweld or flanged ends, Class 150

with handwheel or wrench operator.

2.3 PRESSURE REGULATORS

Regulators shall have ferrous bodies, shall provide backflow and vacuum protection, and shall be designed to meet the pressure, load and other service conditions.

### 2.3.2 Service Line Regulators

Pressure regulators for individual service lines shall have ferrous bodies. Regulator shall be capable of reducing distribution line pressure to pressures required for users. Regulators shall be provided where gas will be distributed at pressures in excess of 2.5 kPa. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Regulator shall have a self contained service regulator. Regulator pipe connections shall not exceed 50 mm size.

## 2.4 METERS

Meters shall conform to ANSI B109.2. Meters shall be pipe or pedestal mounted and be provided with a strainer immediately upstream. Meters shall be provided with over-pressure protection as specified in ASME B31.8. Meters shall be suitable for accurately measuring and handling gas at pressures, temperatures, and flow rates indicated. Meters shall have a pulse switch initiator capable of operating up to speeds of 500 pulses per minute with no false pulses and shall require no field adjustments. Initiators shall provide the maximum number of pulses up to 500 per minute that is obtainable from the manufacturer. It shall provide not less than one pulse per 2.83 cubic meter of gas.

## 2.5 EMERGENCY GAS SUPPLY CONNECTION

The emergency gas supply connection shall consist of piping (same size as service line) and accessories that will enable a portable, commercial-sized gas cylinder system to be connected to the gas piping system. This connection shall be capped to prevent gas leakage with a lockable manual valve located to be capable of shutting off flow. The entire assembly should be contained in a weatherproof, lockable box. The box shall contain permanently installed written instructions stating the type and pressure of the gas allowed to be connected to the line. The instructions shall also indicate and provide specific instruction for testing of the integrity of the building's gas system with an inert gas before the fuel gas connection is made. A subplate shall be provided in the box that is required to be unbolted to gain access to the connection. The subplate shall contain a warning regarding the potential consequences of using gas other than that specified or of failing to test system integrity before hooking up emergency fuel supply.

## 2.6 PROTECTIVE COVERING MATERIALS

### 2.6.1 Thermoplastic Resin Coating System

Continuously extruded polyethylene and adhesive coating system materials shall conform to NACE RP0185, Type A.

# PART 3 EXECUTION

## 3.1 EXCAVATION AND BACKFILLING

Earthwork shall be as specified in Section 02222A EXCAVATION, TRENCHING,

AND BACKFILLING FOR UTILITIES SYSTEMS.

## 3.2 GAS MAINS

Pipe for gas mains shall be steel. Steel pipe and fittings shall be coated with protective covering as specified.

## 3.3 SERVICE LINES AND EMERGENCY GAS SUPPLY CONNECTION

Service lines shall be constructed of materials specified for gas mains and shall extend from a gas main to and including the point of delivery within 1.5 meters of the building. The point of delivery is the meter set assembly. The service lines shall be connected to the gas mains as indicated. Where indicated, service line shall be provided with an isolation valve of the same size as the service line. The service lines shall be as short and as straight as practicable between the point of delivery and the gas main and shall not be bent or curved laterally unless necessary to avoid obstructions or otherwise permitted. Service lines shall be laid with as few joints as practicable using standard lengths of pipe. Shorter lengths shall be used only for closures. Polyethylene or fiberglass service lines shall not be installed aboveground except as permitted in ASME B31.8.

### 3.3.1 Emergency Gas Supply Connection

Provide an aboveground locked, valved and capped emergency gas supply connection upstream of the pressure regulator. The connection shall be located outside of the building within 300 mm of the exterior wall and installed in a weatherproof box which is mounted on the exterior wall and clearly marked with an appropriate metal sign mounted on wall above.

## 3.4 WORKMANSHIP AND DEFECTS

Pipe, tubing, and fittings shall be clear and free of cutting burrs and defects in structure or threading and shall be thoroughly brushed and blown free of chips and scale. Defective pipe, tubing, or fittings shall be replaced and shall not be repaired.

## 3.5 PROTECTIVE COVERING

### 3.5.1 Protective Covering for Underground Steel Pipe

Except as otherwise specified, protective coverings shall be applied mechanically in a factory or field plant especially equipped for the purpose. Valves and fittings that cannot be coated and wrapped mechanically shall have the protective covering applied by hand, preferably at the plant that applies the covering to the pipe. Joints shall be coated and wrapped by hand. Hand coating and wrapping shall be done in a manner and with materials that will produce a covering equal in thickness to that of the covering applied mechanically.

3.5.1.1 Thermoplastic Resin Coating System

The coating system shall conform to NACE RP0185, Type A. The exterior of the pipe shall be cleaned to a commercial grade blast cleaning finish in accordance with SSPC SP 6. Adhesive compound shall be applied to the pipe. Immediately after the adhesive is applied, a seamless tube of polyethylene shall be extruded over the adhesive to produce a bonded seamless coating. The nominal thickness of the pipe coating system shall be 0.25 mm (plus or minus 10 percent) of adhesive and 1.0 mm (plus or minus 10 percent) of polyethylene for pipes up to 400 mm in diameter. For pipes 450 mm and larger in diameter, the pipe coating system thickness shall be 0.25 mm (plus or minus 10 percent) adhesive and 1.5 mm (plus or minus 10 percent) polyethylene. Joint coating and field repair material shall be applied as recommended by the coating manufacturer and shall be one of the following:

a. Heat shrinkable polyethylene sleeves.
b. Polyvinyl chloride pressure-sensitive adhesive tape.
c. High density polyethylene/bituminous rubber compound tape.

The coating system shall be inspected for holes, voids, cracks, and other damage during installation.

3.5.1.2 Inspection of Pipe Coatings

Any damage to the protective covering during transit and handling shall be repaired before installation. After field coating and wrapping has been applied, the entire pipe shall be inspected by an electric holiday detector with impressed current set at a value in accordance with NACE RP0274 using a full-ring, spring-type coil electrode. The holiday detector shall be equipped with a bell, buzzer, or other type of audible signal which sounds when a holiday is detected. All holidays in the protective covering shall be repaired immediately upon detection. The Contracting Officer reserves the right to inspect and determine the suitability of the detector. Labor, materials, and equipment necessary for conducting the inspection shall be furnished by the Contractor.

3.5.2 Protective Covering for Aboveground Piping Systems

Finish painting shall conform to the applicable paragraphs of Section 09900 PAINTING, GENERAL and as follows:

3.5.2.1 Ferrous Surfaces

Shop primed surfaces shall be touched up with ferrous metal primer same type paint as the shop primer. Surfaces that have not been shop primed shall be solvent-cleaned in accordance with SSPC SP 1. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be mechanically cleaned by power wire brushing in accordance with SSPC SP 3 or brush-off blast cleaned in accordance with SSPC SP 7 and primed with ferrous metal primer in accordance with SSPC Paint 25. Primed surfaces shall be finished with two coats of exterior alkyd paint conforming to SSPC Paint 104.

3.5.2.2 Nonferrous Surfaces

Nonferrous surfaces shall not be painted.

3.5.3 Protective Covering for Piping in Valve Boxes and Manholes

Piping in valve boxes or manholes shall receive protective coating as

specified for underground steel pipe.

## 3.6 INSTALLATION

Gas distribution system and equipment shall be installed in conformance with the manufacturer's recommendations and applicable sections of ASME B31.8, AGA-01 and 49 CFR 192. Abandoning existing gas piping shall be done in accordance with ASME B31.8. Pipe shall be cut without damaging the pipe. Unless otherwise authorized, cutting shall be done by an approved type of mechanical cutter. Wheel cutters shall be used where practicable. On steel pipe 150 mm and larger, an approved gas-cutting-and-beveling machine may be used. Cutting of plastic pipe shall be in accordance with AGA-01. Valve installation in plastic pipe shall be designed to protect the plastic pipe against excessive torsional or shearing loads when the valve is operated and from other stresses which may be exerted through the valve or valve box.

### 3.6.1 Installing Pipe Underground

Gas mains and service lines shall be graded as indicated. Joints in steel pipe shall be welded except as otherwise permitted for installation of valves. Mains shall have 600 mm minimum cover; service lines shall have 485 mm minimum cover; and both mains and service lines shall be placed on firmly compacted select material for the full length. Where indicated, the main shall be encased, bridged, or designed to withstand any anticipated external loads as specified in ASME B31.8. The encasement material shall be standard weight black steel pipe with a protective coating as specified. The pipe shall be separated from the casing by insulating spacers and sealed at the ends with casing bushings. Trench shall be excavated below pipe grade, bedded with bank sand, and compacted to provide full-length bearing. Laying the pipe on blocks to produce uniform grade will not be permitted. The pipe shall be clean inside before it is lowered into the trench and shall be kept free of water, soil, and all other foreign matter that might damage or obstruct the operation of the valves, regulators, meters, or other equipment. When work is not in progress, open ends of pipe or fittings shall be securely closed by expandable plugs or other suitable means. Minor changes in line or gradient of pipe that can be accomplished through the natural flexibility of the pipe material without producing permanent deformation and without overstressing joints may be made when approved. Changes in line or gradient that exceed the limitations specified shall be made with fittings. When cathodic protection is furnished, electrically insulated joints or flanges shall be provided. After laying of pipe and testing, trench shall be backfilled in accordance with Section 02222 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITY SYSTEMS.

### 3.6.2 Installing Pipe Aboveground

Aboveground piping shall be protected against dirt and other foreign matter as specified for underground piping. Joints in steel pipe shall be welded; however joints in pipe 40 mm in diameter and smaller may be threaded; joints may also be threaded to accommodate the installation of valves. Flanges shall be of the weld neck type to match wall thickness of pipe.

## 3.7 PIPE JOINTS

Pipe joints shall be designed and installed to effectively sustain the longitudinal pullout forces caused by the contraction of piping or superimposed loads.

### 3.7.1 Threaded Steel Joints

Threaded joints in steel pipe shall have tapered threads evenly cut and shall be made with UL approved graphite joint sealing compound for gas service or polytetrafluoroethylene tape applied to the male threads only. Caulking of threaded joints to stop or prevent leaks will not be permitted.

3.7.2 Welded Steel Joints

Gas pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.8. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected adversely. Electrodes that have been wetted or have lost any of their coating shall not be used.

3.8 VALVE BOXES

Valve boxes of cast iron not less than 4.7 mm thick shall be installed at each underground valve except where concrete or other type of housing is indicated. Valve boxes shall be provided with locking covers that require a special wrench for removal. Wrench shall be furnished for each box. The word "gas" shall be cast in the box cover. When the valve is located in a roadway, the valve box shall be protected by a suitable concrete slab at least 1 square meter. When in a sidewalk, the top of the box shall be in a concrete slab 600 mm square and set flush with the sidewalk. Boxes shall be adjustable extension type with screw or slide-type adjustments. Valve boxes shall be separately supported, not resting on the pipe, so that no traffic loads can be transmitted to the pipe. Valves shall only be located in valve boxes or inside of buildings.

3.9 DRIPS

Drips shall be installed at locations where indicated. Drips shall conform to the details shown or may be commercial units of approved type and capacity. A blow off pipe 32 mm or larger shall be connected to each drip at its lowest point and shall extend to or near the ground surface at a convenient location away from traffic. Discharge for each drip terminal (outlet) shall be provided with a reducing fitting, a plug valve, and a 15 mm nipple turned down. The discharge terminal (outlet) shall be inside a length of 300 mm or larger vitrified clay pipe, concrete sewer pipe or concrete terminal box set vertically on a bed of coarse gravel 300 mm thick and 1 m square, with concrete bottom to contain liquids and a connection to remove liquids for disposal, and closed at the ground surface with a suitable replacement cover.

3.10 PRESSURE REGULATOR INSTALLATION

3.10.2 Service Line Regulators

A shutoff valve, meter set assembly, and service regulator shall be installed on the service line outside the building, 450 mm above the ground on the riser. An insulating joint shall be installed on the inlet side of the meter set assembly and service regulator and shall be constructed to prevent flow of electrical current. A 10 mm tapped fitting equipped with a

plug shall be provided on both sides of the service regulator for installation of pressure gauges for adjusting the regulator. All service regulator vents and relief vents shall terminate in the outside air in rain and insect resistant fittings. The open end of the vent shall be located where gas can escape freely into the atmosphere, away from any openings into the building and above areas subject to flooding.

## 3.11 METER INSTALLATION

Meters shall be installed in accordance with ASME B31.8. Permanent gas meters shall be installed with provisions for isolation and removal for calibration and maintenance, and shall be suitable for operation in conjunction with an energy monitoring and control system.

## 3.12 CONNECTIONS TO EXISTING LINES

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

### 3.12.1 Connections to Publicly or Privately Operated Gas Utility Lines

Contractor shall provide materials for the connections to the existing gas lines. Final connections and the turning on of gas shall be made by the utility. Existing lines that are to be a abandoned or taken out of service shall be disconnected, purged and capped, plugged or otherwise effectively sealed by the Utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of gas lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new gas lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

### 3.12.2 Connection to Government Owned/Operated Gas Lines

The Contractor shall provide connections to the existing gas lines in accordance with approved procedures. Deactivation of any portion of the existing system shall only be done at the valve location shown on the drawings. Reactivation of any existing gas lines will only be done by the Government. The Contractor's Connection and Abandonment Plan shall be submitted and approved prior to making any connections to existing gas lines. This plan shall include the Operating Agency's required procedures. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made.

a. If facilities are abandoned in place, they shall be physically disconnected from the piping system. The open ends of all abandoned facilities shall be purged, capped, plugged or otherwise effectively sealed. Abandonment shall not be completed until it has been determined that the volume of gas or liquid hydrocarbons contained within the abandoned section poses no potential hazard. Air or inert gas may be used for purging, or the facility may be filled with water or other inert material. If air is used for purging, the Contractor shall ensure that a combustible mixture is not present after purging.
b. When a main is abandoned, together with the service lines connected to it, only the customer's end of such service lines is required to be sealed as stipulated above.
c. Service lines abandoned from the active mains shall be disconnected as close to the main as practicable.

d. All valves left in the abandoned segment shall be closed.
e. All abovegrade valves, risers, and vault and valve box covers shall be removed. Vault and valve box voids shall be filled with suitable compacted backfill material.

## 3.13 CATHODIC PROTECTION

Cathodic protection shall be provided for all metallic gas piping installed underground and shall be installed as specified in Section 16640

CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

## 3.14 TESTS

### 3.14.1 Pressure and Leak Tests

The system of gas mains and service lines shall be tested after construction and before being placed in service using air as the test medium. The normal operating pressure for the system is 172kPA. The test pressure is 260kPA. Prior to testing the system, the interior shall be blown out, cleaned and cleared of all foreign materials. All meters, regulators, and controls shall be removed before blowing out and cleaning and reinstalled after clearing of all foreign materials. Testing of gas mains and service lines shall be done with due regard for the safety of employees and the public during the test. Persons not working on the test operations shall be kept out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. Joints in sections shall be tested prior to backfilling when trenches must be backfilled before the completion of other pipeline sections. The test shall continue for at least 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the pipe has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. The temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship $T(1)P(2)=T(2)P(1)$, in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial and final readings. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. The testing instruments shall be approved by the Contracting Officer. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain safety precautions for air pressure testing at all times during the tests.

-- End of Section --

SECTION 02698

PREFABRICATED UNDERGROUND/COOLING DISTRIBUTION SYSTEM

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 53 | (1990b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless |
| ASTM A 105 | (1992) Forgings, Carbon Steel, for Piping Components |
| ASTM A 106 | (1991) Seamless Carbon Steel Pipe for High-Temperature Service |
| ASTM A 234 | (1992a) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures |
| ASTM B 88 | (1993) Seamless Copper Water Tube |
| ASTM C 518 | (1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus |
| ASTM C 591 | (1985) Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation |
| ASTM D 1248 | (1984; R 1989) Polyethylene Plastics Molding and Extrusion Materials |
| ASTM D 1784 | (1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds |
| ASTM D 2241 | (1989) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) |
| ASTM D 2564 | (1991a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems |
| ASTM D 3139 | (1989) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals |
| ASTM D 3517 | (1991) "Fiberglass" (Glass-Fiber - Reinforced Thermosetting-Resin) Pressure Pipe |

| | |
|---|---|
| ASTM F 477 | (1990) Elastomeric Seals (Gaskets) for Joining Plastic Pipe |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|---|---|
| ASME B1.20.1 | (1983; R 1992) Pipe Threads, General Purpose (Inch) |
| ASME B16.9 | (1993) Factory-Made Wrought Steel Buttwelding Fittings |
| ASME B16.11 | (1991) Forged Fittings, Socket-Welding and Threaded |
| ASME B31.1 | (1992; B31.1a; B31.1b) Power Piping |
| ASME BPV IX | (1992; Addenda Dec 1992; Dec 1993) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications |

COPPER DEVELOPMENT ASSOCIATION (CDA)

| | |
|---|---|
| CDA 404/0-RR | (1992) Copper Tube for Plumbing, Heating, Air Conditioning and Refrigeration |

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

| | |
|---|---|
| MSS SP-73 | (1991) Brazing Joints for Copper and Copper Alloy Pressure Fittings |

## 1.2 SYSTEM DESCRIPTION

The system consists of a buried prefabricated chilled water distribution system including service connections to a point 150 mm inside of the building. The contract drawings show the specific arrangement of piping, sizes and grades of pipe, and other details. The system is designed for an operating pressure of 870 kPa and an operating temperature of 6.6 degrees C for chilled water.

## 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

Distribution System; FIO.

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

SD-04 Drawings

Distribution System; FIO.

Detail drawings consisting of fabrication and assembly drawings, for all parts of the work in sufficient detail to check conformity with the requirements of the contract documents, prior to installation. Detail drawings shall also contain complete piping, wiring and schematic diagrams and any other details to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout, method of compensation for pipe expansion and contraction, anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances required for maintenance and operation. The drawings shall clearly identify any proposed deviations from the requirements of the contract documents.

SD-13 Certificates

Distribution System; FIO.

The manufacturer's or system fabricator's written certification stating that the distribution system furnished meets all the requirements of this specification.

Welding Procedures and Operators; FIO.

Prior to welding operations, a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

1.4 DELIVERY AND STORAGE

After delivery to the jobsite, all materials and equipment shall be protected from anything which could cause damage to the material or equipment. All pipe shall be sealed at each end to keep the interior clean and free of dirt and debris. Fittings shall be kept together and their interior surfaces shall remain clean. Any insulation shall be kept dry and clean.

1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.6 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. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

2.1 STANDARD PRODUCTS

System components shall be standard products of a manufacturer regularly

engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. The system shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

## 2.2 PIPING AND CASING MATERIALS

### 2.2.1 General

Metallic pressure pipe, fittings, and piping accessories shall conform to the requirements of ASME B31.1 and shall be types suitable for the temperature and pressure of the water.

### 2.2.2 Piping

#### 2.2.2.1 Steel Pipe

Piping shall conform to ASTM A 53, Grade B, standard weight, black or to ASTM A 106, Grade B, standard weight.

#### 2.2.2.2 Copper Tubing

Copper tubing shall conform to ASTM B 88, Type K or L.

#### 2.2.2.3 Reinforced Thermosetting Resin Pipe (RTRP)

RTRP pipe shall conform to ASTM D 3517.

#### 2.2.2.4 Polyvinyl Chloride (PVC) Pipe

PVC pipe shall conform to ASTM D 2241 with a Standard Thermoplastic Pipe Dimension Ratio (SDR) of 26 and PVC 1120 or 1220 as the material.

### 2.2.3 Casings

#### 2.2.3.1 Polyvinyl Chloride (PVC) Casing

PVC casings shall conform to ASTM D 1784, Class 12454-B with a minimum thickness equal to the greater of one-hundredth the diameter of the casing or 1.50 mm.

#### 2.2.3.2 Polyethylene (PE) Casing

Polyethylene casings shall conform to ASTM D 1248, Type III, Class C, Category 3 or 4, Grade P 34 with thickness as follows:

| Casing Diameter (in mm) | Minimum Thickness (in mm) |
|---|---|
| 250 and smaller | 3 |
| 250 to 450 | 4 |
| 450 to 600 | 5 |
| over 600 | 6 |

#### 2.2.3.3 Reinforced Thermosetting Resin Pipe (RTRP) Casing

RTRP casing shall be of the same material as designated for the pipe with

casing thickness as follows:

| Casing Diameter (in mm) | Minimum Thickness (in mm) |
|---|---|
| 200 and smaller | 1.2 |
| 250 | 2 |
| 300 | 2.7 |
| 350 | 2.9 |
| 400 to 450 | 3 |
| 500 | 3.2 |
| 600 | 3.9 |

2.3 PIPING CONNECTIONS

2.3.1 Steel Pipe

Steel pipe smaller than 20 mm may be threaded, otherwise, all steel pipe shall be welded. Steel welding fittings shall conform to the requirements of ASTM A 105 or ASTM A 234. Welding fittings shall also conform to ASME B16.9 for buttweld fittings and ASME B16.11 for socket-weld fittings. Long radius buttwelding elbows conforming to ASME B16.9 shall be used whenever space permits. Pipe Threads shall conform to ASME B1.20.1. Pipe to be threaded shall be schedule 80.

2.3.2 Copper Pipe

Copper pipe shall be brazed or connected using an insulated pipe coupling. Wrought copper or cast copper alloy solder joint pressure fittings shall conform to MSS SP-73. Insulated pipe couplings for copper pipe shall be cast bronze containing an O-ring seal on each end and shall be jacketed and sealed to act as an expansion joint.

2.3.3 Plastic Pipe

a. Pipe, fittings, flanges, and couplings shall have end connections of the adhesive bell and spigot type. Threaded piping, including pipe, fittings, flanges, and couplings, will not be permitted.

b. Flanged Connections: Flat face flanged connections shall be provided between plastic piping and metal piping. Plastic flanges shall be suitable for connection to ASME Class 150 flanges.

c. RTRP Piping Sizes: When piping sizes other than 50, 75, 100, 150, and 200 mm are indicated, the next larger piping size shall be provided. The connecting system piping shall be of the same size or increased to meet the next size of RTRP piping.

2.3.3.1 General

Plastic fittings shall be made of the same type and grade of material as the piping to which they will be connected and shall be furnished by the manufacturer who supplies the pipe. Fittings shall have temperature and pressure ratings not less than those of the connecting piping.

2.3.3.2 Polyvinyl Chloride (PVC)

Polyvinyl chloride (PVC) pipe shall be solvent welded or connected using bell and spigot connections. The solvent used to connect fittings and pipe shall conform to the requirements of ASTM D 2564. Bell and spigot joints utilizing elastomeric seals shall conform to the requirements of ASTM D 3139. The elastomeric seals shall conform to ASTM F 477.

2.3.3.3 Reinforced Thermosetting Resin Plastic (RTRP)

Reinforced thermosetting resin plastic pipe shall be joined using fittings and adhesive furnished by the pipe manufacturer in accordance with ASTM D 3517.

2.4 END SEALS

2.4.1 General

Each preinsulated section of piping shall have a complete sealing of the insulation to provide a permanent water and vapor seal at each end of the preinsulated section of piping. Preinsulated sections of piping modified in the field shall be provided with an end seal which is equivalent to the end seals furnished with the preinsulated section of piping. End seals must be tested and certified in accordance with paragraph Casing and End

Seal Testing and Certification.

2.4.2 Types

End seals provided shall be one of the following types:

a. Carrying the outer casing over tapered pipe insulation ends and extending it to the carrier pipe. Sufficient surface bonding area shall be provided between the casing and the carrier pipe.

b. Using specially designed molded caps made of polyethylene or rubber of standard manufactured thickness. A minimum 40 mm surface bonding area shall be provided between the cap and both the casing and carrier pipe.

c. Using elastomer-ring end seals designed and dimensioned to fit in the annular space between the casing and the carrier pipe.

d. Using a waterproof mastic seal vapor barrier over the exposed insulation ends.

e. Shrink sleeves.

2.4.3 Casing and End Seal Testing and Certification

Testing and certification procedures by an independent testing laboratory shall demonstrate that casings and end seals are capable of resisting penetration of water into the casing and insulation. The test shall be performed on the type of prefabricated system to be furnished. If more than one type of prefabricated system is to be used, then the tests shall be performed on each type. The test shall consist of hot and cold cycle testing followed by immersion in a water filled chamber with a head pressure. The hot and cold cycle testing shall consist of 14 days of temperature cycling. A fluid with a temperature of 5 degrees C shall circulate through the carrier pipe alternating every 24-hours with a fluid with a temperature of 95 degrees C circulating through the carrier pipe for a

low temperature hot water or dual temperature service or 24 degrees for a chilled water service. While the hot and cold cycle test is being performed, the test sample is either buried or encased in dry bedding sand with a minimum of 300 mm of sand all around the test sample. The carrier pipe size of the test sample shall be 80 mm in diameter and shall be restrained during the test period. The insulation thickness shall not exceed the maximum thickness provided for the piping in the project. Transition time for temperature cycle testing shall not exceed 15 minutes in going from cold to hot and 30 minutes in going from hot to cold. The fluid in the carrier pipe may be water, oil or heat transfer fluid. Following the hot and cold cycling test, the test sample shall be immersed in a water filled chamber. The pressure on the highest point of the test sample shall not be less than 60 kPa subjected over the entire length of the 2.4 mm test sample of prefabricated pipe. The water shall contain a dye penetrant, which will be used to check for end seal leakage. The pressure in the chamber must be held for not less than 48 hours. Upon completion of this pressure test, the test sample shall be cut open. With the use of a light that will readily show the presence of the dye that was in the water, the test sample shall be inspected. Evidence of the dye inside the test sample shall indicate that the end seal is not acceptable and cannot be certified. A pipe manufacturer who has a current Federal Letter of Acceptability for a system furnished under this section will be exempt from the testing specified in this paragraph.

2.5 INSULATION

2.5.1 Factory Applied Insulation

Prefabricated pipe and fittings shall be insulated in the factory. Foam insulation for prefabricated insulated pipe and fittings shall be polyurethane foam meeting the requirements of ASTM C 591 having a density not less than 32 kg per cubic meter. The polyurethane foam shall completely fill the annular space between the carrier pipe and the casing. Insulation thickness shall be a minimum of 25 mm. The insulation thermal conductivity factor shall not exceed the numerical value of 0.02 W/mK at 24 degrees C, when tested in accordance with ASTM C 518. Manufacturer shall certify that the insulated pipe is free of insulation voids.

2.5.2 Field Applied Insulation

Field applied insulation for fittings, and field casing closures, if required, and other piping system accessories shall be polyurethane matching the pipe insulation. Thickness shall match adjacent piping insulation thickness. Buried fittings and accessories shall have field applied polyurethane insulation to match adjacent piping and shall be protected with a covering matching the pipe casing. Shrink sleeves with a minimum thickness of 1.3 mm shall be provided over casing connection joints.

3.1 INSTALLATION

For all preinsulated, prefabricated systems, the Contractor shall obtain the services of a trained representative of the pipe system manufacturer to instruct the Contractor's work forces in the installation procedures to ensure that the system is installed in accordance with the manufacturer's PUBLISHED instructions and the plans and specifications. The manufacturer's representative shall be a person who regularly performs such duties for the manufacturer. The Contractor shall furnish the ContractingOfficer a list of names of personnel trained and certified by the pipe system manufacturer in the installation of this system. Only personnel whose names appear on the

list will be allowed to install the system. The list shall not be more than 1 year old.

## 3.2 PIPING SYSTEMS

### 3.2.1 Buried Insulated Systems

Buried insulated systems shall consist of carrier pipe, insulation, casing, end seals, fittings and accessories as specified.

## 3.3 OMITTED

## 3.4 THRUST BLOCKS

Thrust blocks shall be installed at the locations shown or recommended by the pipe system manufacturer. Thrust blocks may not be required on all systems, and the need for thrust blocks shall be as recommended by the system manufacturer. Thrust blocks, if necessary, shall be installed at all changes in direction, changes in size, valves and terminal ends, such as plugs, caps and tees. Thrust blocks shall be concrete having a compressive strength of not less than 14 MPa after 28 days and shall be in accordance with Section 03300 CONCRETE FOR BUILDING CONSTRUCTION. Thrust blocks shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and the thrust bearing sides of the thrust blocks shall be poured directly against undisturbed earth. The sides of the thrust blocks not subject to thrust may be poured against forms. Thrust blocks shall be placed so that the joints for all fittings will be accessible for repair wherever possible. No pipe joint shall be embedded in concrete unless the assembly has previously been hydrostatically tested. The thrust blocks shall provide for transfer of thrusts and reactions without exceeding the allowable stress of the concrete and shall be installed in accordance with pipe manufacturer's instructions. In muck or peat, all thrusts shall be resisted by piles or tie rods to solid foundations or by removal of peat or muck which shall be replaced with ballast of sufficient stability to resist thrusts.

## 3.5 INSTALLATION OF PIPING SYSTEMS

The piping system furnished shall be installed in accordance with the piping system manufacturer's instructions. Piping shall be installed without springing or forcing other than what has been calculated for cold spring. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints or hangers. Nonmetallic pipe cut in the field shall be machined to fit couplings or joints and shall be coated or treated to match standard factory coated ends. Copper tubing shall not be installed in the same trench with ferrous piping materials. When nonferrous metallic pipe (e.g., copper tubing) crosses any ferrous piping material, a minimum vertical separation of 300 mm shall be maintained between pipes. Connections between different types of pipe and accessories shall be made with transition fittings approved by the manufacturer of the piping system.

### 3.5.1 Pitching of Horizontal Piping

Horizontal piping shall be pitched at a grade of not less than 40 mm in 1 m toward the drain points unless otherwise indicated.

3.5.2 Open Ends

Open ends of pipelines and equipment shall be properly capped or plugged during installation to keep dirt and other foreign matter out of the system.

3.5.3 Cutting Prefabricated Piping Sections

Where prefabricated pipe sections are field cut, new end seals similar to the factory applied end seal shall be provided and installed in accordance with the manufacturer's instructions.

3.5.4 Joints

3.5.4.1 Welded Joints

Welded joints between sections of pipe and between pipe and fittings shall be provided where specified or indicated.

3.5.4.2 Threaded Joints

Threaded joints shall not be used belowground. Joints shall be made tight with polytetrafluoroethylene tape applied to the male threads only. Not more than three threads shall show after the joint is made up.

3.5.4.3 Brazed Joints

Brazed joints for copper pipe and fittings shall conform to CDA 404/0-RR. Brazing alloys melting above 593.3 degrees C shall be utilized.

3.5.4.4 Nonmetallic Pipe Joints

Nonmetallic pipe joints shall be installed in accordance with the written instructions of the manufacturer.

3.5.5 Omitted
3.5.6 Omitted
3.5.7 Omitted

3.5.8 Underground Warning Tape

Underground warning tape shall be buried above the piping during the trench backfilling and shall be buried approximately 300 mm deep. Tape shall be thick polyethylene tape. Tape shall be 150 mm wide and be printed with repetitive caution warnings along its length. Tapes shall be yellow in color with black letters. Tape color and lettering shall not be affected by moisture or other substances contained in the backfill material.

3.5.9 Markers for Underground Piping

Markers for underground piping shall be so located along the distribution and service lines. Markers shall be placed approximately 600 mm to the right of the distribution system and referenced to the flow direction in the supply line. The marker shall be concrete 150 mm square or round section 600 mm long. The top edge of the marker shall have a minimum 10 mm chamfer all around. The letters CHW shall be impressed or cast on the top of the markers to indicate the type of system that is being identified. Each letter shall be formed with a V-shaped groove and shall have a width of stroke at least 6 mm

at the top and depth of 6 mm. The top of the marker shall protrude not more than 25 mm above finished grade.

3.6 OMITTED
3.7 OMITTED

3.8 TESTING

Tests shall be conducted before, during, and after installation of the system. All instruments, equipment, facilities, and labor required to properly conduct the tests shall be provided by the Contractor. Test pressure gauges for a specific test shall have dials indicating not less than 1-1/2 times nor more than 2 times the test pressure. It shall be the Contractor's responsibility to make the pipe system workable at his expense.

3.8.1 Omitted

3.8.2 Carrier Piping Tests

Distribution piping shall be tested as required before backfilling and with all joints exposed. The area between joints may be backfilled as necessary to prevent pipe movement.

3.8.2.1 Cleaning Carrier Pipe

Prior to testing, the interior of the carrier pipe shall be cleaned of all foreign materials by thorough flushing with clean water. Supplementary pumps shall be provided to circulate the water at a velocity between 2 and 3 m/s for a minimum of 4 hours. Any system strainers shall be cleaned after the flushing operation is complete. Temporary strainers shall be installed as required. After circulation, the water shall be drained out of the piping system and the piping system filled with treated water for permanent operation of the system. All air must be removed from the system prior to starting the tests.

3.8.2.2 Hydrostatic Pressure Cycling and Test

Hydrostatic pressure cycling will have four cycles. Each cycle shall consist of a 10 minute period at 1000 kPa followed by a 5 minute period at a pressure less than 350 kPa. The next cycle will begin immediately following the completion of the previous cycle. Pressure rise and drop shall not exceed 690 kPa per minute. The pressure gauge shall be located and the pressure measured at the opposite end of the system from where the pressure is applied. After completion of the hydrostatic pressure cycling the first hydrostatic pressure test may be performed. During the first hydrostatic pressure test the system shall be proven tight at a pressure of 1-1/2 times the working pressure up to 1000 kPa. This pressure shall be held for a minimum of 1 hour. The method of pressurizing the system shall be disconnected from the system before starting the 1 hour pressure holding period. If the pressure cannot be held for the specified length of time, the cause of pressure loss shall be determined, corrected and the hydrostatic pressure cycling and first hydrostatic pressure test repeated until the system can hold the required pressure for at least 1 hour.

3.8.2.3 Operational Test

Operational test shall be performed on the complete system or testable

portions thereof. The test shall be conducted with full design flows and operating temperatures in all runs of piping as if in service, to demonstrate satisfactory function and operating effectiveness. The operational test will have two cycles. Each cycle shall consist of a 6-hour period with water in the system at the maximum operating temperature of 50 degrees C and maximum flow rate and a period of at least 6 hours with no flow rate. The Contractor shall supply temporary pumps, piping connections, boilers, chillers and the gauges required to circulate the water at the desired temperatures and flow rates. Water shall be circulated through supply lines and returned through the return piping to demonstrate that the pressure drop is compatible with the flow rate and size of pipe and to show that obstructions do not exist in the piping system. Any unusual indicated pressure drop will be investigated and any obstructions removed. Any leaks found shall be repaired. After any obstructions have been removed and any leaks repaired, the operational test shall be repeated.

3.8.3.4 Final Hydrostatic Test

After successful completion of the operational test, the system shall be pressurized to 1-1/2 times the working pressure up to 1000 kPa. This pressure shall be held for a minimum of 4 hours. The method of pressurizing the system shall be disconnected from the system prior to the start of the 4-hour pressure holding period. If the pressure cannot be held for the specified length of time, the cause of the pressure loss shall be determined, corrected, and all of the tests repeated.

-- End of Section --

SECTION 02720

STORM-DRAINAGE SYSTEM

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

| | |
|---|---|
| AASHTO-01 | (1992; Interim specs 1993, 1994, 1995) Standard Specifications for Highway Bridges |
| AASHTO M 167 | (1994) Corrugated Steel Structural Plate, Zinc Coated, for Field Bolted Pipe |
| AASHTO M 190 | (1988) Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches |
| AASHTO M 198 | (1994) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets |
| AASHTO M 219 | (1992) Aluminum Alloy Structural Plate for Field Bolted Conduits |
| AASHTO M 243 | (1994) Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches |
| AASHTO M 294 | (1994) Corrugated Polyethylene Pipe, 12-to 36 in. Diameter |

ACI INTERNATIONAL (ACI)

| | |
|---|---|
| ACI 346/346R | (1990) Standard Specification for Cast-in-Place Nonreinforced Concrete Pipe and Recommendations |

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)

| | |
|---|---|
| AREA-03 | (1994) Manual for Railway Engineering (Fixed Properties): Chapter 1, Roadway and Ballast |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 48 | (1994a) Gray Iron Castings |
| ASTM A 123 | (1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM A 444 | (1989) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Storm Sewer and Drainage Pipe |

| | |
|---|---|
| ASTM A 536 | (1984; R 1993) Ductile Iron Castings |
| ASTM A 716 | (1995) Ductile Iron Culvert Pipe |
| ASTM A 742 | (1993) Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe |
| ASTM A 760 | (1995a) Corrugated Steel Pipe Metallic-Coated for Sewers and Drains |
| ASTM A 762 | (1993a) Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains |
| ASTM A 798 | (1994) Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications |
| ASTM A 807 | (1994) Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications |
| ASTM A 849 | (1994) Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe |
| ASTM B 26 | (1995) Aluminum-Alloy Sand Castings |
| ASTM B 745 | (1993) Corrugated Aluminum Pipe for Sewers and Drains |
| ASTM C 12 | (1995) Installing Vitrified Clay Pipe Lines |
| ASTM C 14 | (1995) Concrete Sewer, Storm Drain, and Culvert Pipe |
| ASTM C 32 | (1993) Sewer and Manhole Brick (Made from Clay or Shale) |
| ASTM C 55 | (1995) Concrete Building Brick |
| ASTM C 62 | (1995) Building Brick (Solid Masonry Units Made from Clay or Shale) |
| ASTM C 76 | (1995) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe |
| ASTM C 139 | (1995) Concrete Masonry Units for Construction of Catch Basins and Manholes |
| ASTM C 231 | (1991b) Air Content of Freshly Mixed Concrete by the Pressure Method |
| ASTM C 270 | (1995) Mortar for Unit Masonry |
| ASTM C 425 | (1995) Compression Joints forVitrified Clay Pipe and Fittings |
| ASTM C 443 | (1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets |
| ASTM C 478 | (1994) Precast Reinforced Concrete Manhole Sections |
| ASTM C 506 | (1995) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe |

| | | |
|---|---|---|
| | ASTM C 507 | (1995) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe |
| | ASTM C 655 | (1994) Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe |
| | ASTM C 700 | (1995) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated |
| | ASTM C 789 | (1994) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers |
| | ASTM C 850 | (1994) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less than 2 Ft. of Cover Subjected to Highway |
| | ASTM C 877 | (1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe |
| | ASTM D 1056 | (1991) Flexible Cellular Materials -Sponge or Expanded Rubber |
| | ASTM D 1171 | (1994) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens) |
| *3 | 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 1751 | (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |
| | ASTM D 1752 | (1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction |
| | ASTM D 1784 | (1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds |
| *3 | ~~ASTM D 2167~~ | ~~(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method~~ |
| | ASTM D 2321 | (1989) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications |
| *3 | ~~ASTM D 2922~~ | ~~(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)~~ |
| *3 | ~~ASTM D 3017~~ | ~~(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)~~ |
| | ASTM D 3034 | (1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings |
| | ASTM D 3212 | (1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals |

| | |
|---|---|
| ASTM D 3350 | (1993) Polyethylene Plastics Pipe and Fittings Materials |
| ASTM F 477 | (1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe |
| ASTM F 679 | (1989) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings |
| ASTM F 714 | (1994) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter |
| ASTM F 794 | (1993a) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter |
| ASTM F 894 | (1994a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe |
| ASTM F 949 | (1993a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings |

1.2 MEASUREMENT AND PAYMENT

Storm drainage work, with the exception of the items designated herein will be paid for at the lump sum contract price.

1.2.1 *Omitted*
1.2.2 *Omitted*
1.2.3 *Omitted*
1.2.4 *Omitted*
1.2.5 *Omitted*

1.2.6 Rock Excavation

Payment will be made for the number of cubic meters (yards) of material acceptably excavated, as specified and defined as rock excavation in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, measured in the original position, and computed by allowing actual width of rock excavation with the following limitations:

Maximum rock excavation width, 750 mm (30 inches) for pipe of 300 mm (12-inch) or less nominal diameter; maximum rock excavation width, 400 mm (16 inches) greater than outside diameter of pipe of more than 300 mm (12-inch) nominal diameter. Measurement will include authorized overdepth excavation. Payment will also include all necessary drilling and blasting, and all incidentals necessary for satisfactory excavation and disposal of authorized rock excavation. No separate payment will be made for backfill material required to replace rock excavation; this cost shall be included in the Contractor's unit price bid per cubic meter (yard) for rock excavation. In rock excavation for manholes and other appurtenances, 300 mm (1 foot) will be allowed outside the wall lines of the structures.

1.2.7 Backfill Replacing Unstable Material

Payment will be made for the number of cubic meters (yards) of select granular material required to replace unstable material for foundations under pipes or drainage structures, which will constitute full compensation for this backfill material, including removal and disposal of unstable material and all excavating, hauling, placing, compacting, and all incidentals necessary to complete the construction of the foundation satisfactorily.

1.2.8 Pipe Placed by Jacking

Payment will be made for the number of linear meters (feet) of jacked pipe accepted in the completed work measured along the centerline of the pipe in place.

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-06 Instructions

Placing Pipe; FIO.

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

SD-13 Certificates

Resin Certification; FIO. Pipeline Testing; FIO. Hydrostatic Test on Watertight Joints; FIO. Determination of Density; FIO. Frame and Cover for Gratings; FIO.

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed. Certification on the ability of frame and cover or gratings to carry the imposed live load.

SD-14 Samples

Pipe for Culverts and Storm Drains; FIO.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Gasket materials and plastic materials shall be protected from exposure to the direct sunlight over extended periods.

1.4.2 Handling

Materials shall be handled in such a manner as to ensure delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

ASTM C 76, Class III.

2.1.1.1 Reinforced Arch Culvert and Storm Drainpipe

ASTM C 506, Class A-III.

2.1.1.2 Reinforced Elliptical Culvert and Storm Drainpipe

ASTM C 507. Horizontal elliptical pipe shall be Class HE-III. Vertical elliptical pipe shall be Class VE-III.

2.1.1.3 Nonreinforced Pipe

ASTM C 14, Class 3.

2.1.1.4 Cast-In-Place Nonreinforced Conduit

ACI 346/346R, except that testing shall be the responsibility of and at the expense of the Contractor. In the case of other conflicts between ACI 346/346R and project specifications, requirements of ACI 346/346R shall govern.

2.1.2 Clay Pipe

Standard or extra strength, as indicated, conforming to ASTM C 700.

2.1.3 Corrugated Steel Pipe

ASTM A 760,aluminum-zinc alloy coated pipe of either:

a. Type II pipe with helical corrugations.

b. Type IIA pipe with helical corrugations fabricated with a smooth steel liner of Type C precoated sheet with a polymeric coating on both sides of not less than 0.25 mm (0.010 inch) thick conforming to ASTM A 742.

c. Type IIR pipe with helical corrugations.

2.1.3.1 Fully Bituminous Coated

AASHTO M 190 Type A and ASTM A 760 aluminum-zinc alloy coated pipe of either:

a. Type II pipe with helical corrugations.

b. Type IIA pipe with helical corrugations fabricated with a smooth steel liner of Type C precoated sheet with a polymeric coating on both sides of not less than 0.25 mm (0.010 inch) thick conforming to ASTM A 742. Bituminous coating shall only be applied to the outside surface of the shell and the inside surface of the liner.

c. Type IIR pipe with helical corrugations.

2.1.3.2 Half Bituminous Coated, Part Paved

*2 AASHTO M 190 Type B and ASTM A 760 ~~[zinc coated] [aluminum coated]~~ aluminum-zinc alloy coated pipe of either:

a. Type II pipe with helical corrugations.

b. Type IIA pipe with helical corrugations fabricated with a smooth steel liner of Type C precoated sheet with a polymeric coating on both surfaces of liner of not less than 0.25 mm (0.010 inch) thick conforming to ASTM A 742. Bituminous coating shall be applied to the outside surface of the shell and the inside surface of the liner.

c. Type IIR pipe with helical corrugations.

2.1.3.3 Fully Bituminous Coated, Part Paved

AASHTO M 190 Type C and ASTM A 760 aluminum-zinc alloy coated pipe of either:

a. Type II pipe with helical corrugations.

b. Type IIA pipe with helical corrugations fabricated with a smooth steel liner of Type C precoated sheet with a polymeric coating on both surfaces of liner of not less than 0.25 mm (0.010 inch) thick conforming to ASTM A 742. Bituminous coating shall be applied to the outside surface of the shell and the inside surface of the liner.

c. Type IIR pipe with helical corrugations.

2.1.3.4 Fully Bituminous Coated, Fully Paved

AASHTO M 190 Type D and ASTM A 760 aluminum-zinc alloy coated Type II, IIR corrugated steel pipe with helical corrugations.

2.1.3.5 Concrete-Lined

ASTM A 760 aluminum-zinc alloy coated Type IR corrugated steel pipe with helical corrugations and a concrete lining in accordance with ASTM A 849. The concrete lining shall be not less than 9.5 mm (3/8 inch) over the inside crest of the corrugation.

2.1.3.6 Precoated

ASTM A 762 corrugated steel pipe fabricated from ASTM A 742 Grade 10/10 of either:

*2 a. Type II pipe with ~~[annular]~~ helical corrugations.

b. Type IIR pipe with helical corrugations.

2.1.3.7 Precoated, Part Paved

ASTM A 762 corrugated steel pipe and AASHTO M 190 Type B (modified), paved invert only, fabricated from ASTM A 742 Grade 10/10 precoated sheet of either:

a. Type II pipe with helical corrugations.

b. Type IIR pipe with helical corrugations.

2.1.3.8 Precoated, Fully Paved

ASTM A 762 Type II corrugated steel pipe and AASHTO M 190 Type D (modified), fully paved only, fabricated from ASTM A 742 Grade 10/10 precoated sheet and helical corrugations.

2.1.4 Corrugated Aluminum Alloy Pipe

ASTM B 745 corrugated aluminum alloy pipe of either:

a. Type II pipe with helical corrugations.

b. Type IIR pipe with helical corrugations.

2.1.4.1 Fully Bituminous Coated

AASHTO M 190 Type A and ASTM B 745 corrugated aluminum alloy pipe of either:

*2 a. Type II pipe with ~~[annular]~~ helical corrugations.

b. Type IIR pipe with helical corrugations.

2.1.4.2 Fully Bituminous Coated, Part Paved

AASHTO M 190 Type C and ASTM B 745 corrugated aluminum alloy pipe of either:

a. Type II pipe with helical corrugations.

b. Type IIR pipe with helical corrugations.

2.1.5 Structural Plate, Steel Pipe, Pipe Arches and Arches

2.1.6 Structural Plate, Aluminum Pipe, Pipe Arches and Arches

Assembled with either aluminum alloy, aluminum coated steel, stainless steel or zinc coated steel nuts and bolts. Nuts and bolts, and aluminum alloy plates shall conform to AASHTO M 219. Pipe coating, when required, shall conform to the requirements of AASHTO M 190, Type A. Thickness of plates shall be as indicated.

2.1.7 Ductile Iron Culvert Pipe

ASTM A 716.

2.1.8 PVC Pipe

The pipe manufacturer's resin certification indicating the cell classification of PVC used to manufacture the pipe shall be submitted prior to installation of the pipe.

2.1.8.1 Type PSM PVC Pipe

ASTM D 3034, Type PSM, maximum SDR 35, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.8.2 Profile PVC Pipe

ASTM F 794, Series 46, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.8.3 Smooth Wall PVC Pipe

ASTM F 679 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.8.4 Corrugated PVC Pipe

ASTM F 949 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

2.1.9 PE Pipe

The pipe manufacturer's resin certification indicating the cell classification of PE used to manufacture the pipe shall be submitted prior to installation of the pipe. The minimum cell classification for polyethylene plastic shall apply to each of the seven primary properties of the cell classification limits in accordance with ASTM D 3350.

2.1.9.1 Smooth Wall PE Pipe

ASTM F 714, maximum DR of 21 for pipes 80 to 600 mm (3 to 24 inches) in diameter and maximum DR of 26 for pipes 650 to 1200 mm (26 to 48 inches) in diameter. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class 335434C.

2.1.9.2 Corrugated PE Pipe

AASHTO M 294, Type S, produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class 315412C or 324420C. Pipe walls shall have the following properties:

| Nominal Size (mm) | Minimum Wall Area (square mm/m) | Minimum Moment of Inertia of Wall Section (mm to the 4th/mm) |
|---|---|---|
| 300 | 3200 | 390 |
| 375 | 4000 | 870 |
| 450 | 4900 | 1020 |
| 600 | 6600 | 1900 |
| 750 | 8300 | 2670 |
| 900 | 9500 | 3640 |

| Nominal Size (in.) | Minimum Wall Area (square in/ft) | Minimum Moment of Inertia of Wall Section (in to the 4th/in) |
|---|---|---|
| 12 | 1.50 | 0.024 |
| 15 | 1.91 | 0.053 |
| 18 | 2.34 | 0.062 |
| 24 | 3.14 | 0.116 |
| 30 | 3.92 | 0.163 |
| 36 | 4.50 | 0.222 |

2.1.9.3 Profile Wall PE Pipe

ASTM F 894, RSC 160, produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class 334433C. Pipe walls shall have the following properties:

| | | Minimum Moment Of Inertia of Wall Section (mm to the 4th/mm) | |
|---|---|---|---|
| Nominal Size (mm) | Minimum Wall Area (square mm/m) | Cell Class 334433C | Cell Class 335434C |
| 450 | 6300 | 850 | 620 |
| 525 | 8800 | 1150 | 840 |
| 600 | 9900 | 1330 | 970 |
| 675 | 12500 | 2050 | 1490 |
| 750 | 12500 | 2050 | 1490 |
| 825 | 14800 | 2640 | 2160 |
| 900 | 17100 | 3310 | 2700 |
| 1050 | 16500 | 4540 | 3720 |
| 1200 | 18700 | 5540 | 4540 |

Minimum Moment Of Inertia of Wall Section (in to the 4th/in)

| Nominal Size (in.) | Minimum Wall Area (square in/ft) | Cell Class 334433C | Cell Class 335434C |
|---|---|---|---|
| 18 | 2.96 | 0.052 | 0.038 |
| 21 | 4.15 | 0.070 | 0.051 |
| 24 | 4.66 | 0.081 | 0.059 |
| 27 | 5.91 | 0.125 | 0.091 |
| 30 | 5.91 | 0.125 | 0.091 |
| 33 | 6.99 | 0.161 | 0.132 |
| 36 | 8.08 | 0.202 | 0.165 |
| 42 | 7.81 | 0.277 | 0.227 |
| 48 | 8.82 | 0.338 | 0.277 |

## 2.2 DRAINAGE STRUCTURES

### 2.2.1 Flared End Sections

Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A 444.

### 2.2.2 Precast Reinforced Concrete Box

For highway loadings with 600 mm (2 feet) of cover or more or subjected to dead load only, ASTM C 789; for less than 600 mm (2 feet) of cover subjected to highway loading, ASTM C 850.

## 2.3 MISCELLANEOUS MATERIALS

### 2.3.1 Concrete

*2 Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for ~~[_____]~~ 2070 MPa 3000 (psi) concrete under Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 37.5 mm (1-1/2 inches). Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall not be less than 25 mm (1 inch) thick for covers and not less than 40 mm (1-1/2 inches) thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 75 mm (3 inches) between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

### 2.3.2 Mortar

*2 Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed ~~[_____]~~ 16.9 liters (4 gallons) of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

### 2.3.3 Precast Concrete Segmental Blocks

Precast concrete segmental block shall conform to ASTM C 139, not more than 200 mm (8 inches) thick, not less than 200 mm (8 inches) long, and of such shape that joints can be sealed effectively and bonded with cement mortar.

2.3.4 Brick

Brick shall conform to ASTM C 62, Grade SW; ASTM C 55, Grade S-I or S-II; or ASTM C 32, Grade MS. Mortar for jointing and plastering shall consist of one part portland cement and two parts fine sand. Lime may be added to the mortar in a quantity not more than 25 percent of the volume of cement. The joints shall be filled completely and shall be smooth and free from surplus mortar on the inside of the structure. Brick structures shall be plastered with 10 mm (1/2 inch) of mortar over the entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course. For round structures, brick shall be laid radially with every sixth course a stretcher course.

2.3.5 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure. ~~[shall be made with flexible watertight, rubber-type gaskets meeting the requirements of paragraph JOINTS].~~ *2

2.3.6 Prefabricated Corrugated Metal Manholes

Manholes shall be of the type and design recommended by the manufacturer. Manholes shall be complete with frames and cover, or frames and gratings.

2.3.7 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48, Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12; or cast aluminum, ASTM B 26, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

2.3.8 Joints

2.3.8.1 Flexible Watertight Joints

a. Materials: Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe and with factory-fabricated resilient materials for clay pipe. The design of joints and the physical requirements for plastic gaskets shall conform to AASHTO M 198, and rubber-type gaskets shall conform to ASTM C 443. Factory-fabricated resilient joint materials shall conform to ASTM C 425. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 1.35 m (54 inches).

b. Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C 443. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished if specifically approved.

2.3.8.2 External Sealing Bands

Requirements for external sealing bands shall conform to ASTM C 877.

2.3.8.3 Flexible Watertight, Gasketed Joints

a. Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 178 mm (7 inches) wide and approximately 9.5 mm (3/8 inch) thick, meeting the requirements of ASTM D 1056, Type 2 A1, and shall have a quality retention rating of not less than 70 percent when tested for weather resistance by ozone chamber exposure, Method B of ASTM D 1171. Rubber O-ring gaskets shall be 20.6 mm (13/16 inch) in diameter for pipe diameters of 914 mm (36 inches) or smaller and 22.2 mm (7/8 inch) in diameter for larger pipe having 12.7 mm (1/2 inch) deep end corrugation. Rubber O-ring gaskets shall be 34.9 mm (1-3/8 inches) in diameter for pipe having 25 mm (1 inch) deep end corrugations. O-rings shall meet the requirements of AASHTO M 198 or ASTM C 443. Flexible plastic gaskets shall conform to requirements of AASHTO M 198, Type B.

b. Connecting Bands: Connecting bands shall be of the type, size and sheet thickness of band, and the size of angles, bolts, rods and lugs as indicated or where not indicated as specified in the applicable standards or specifications for the pipe. Exterior rivet heads in the longitudinal seam under the connecting band shall be countersunk or the rivets shall be omitted and the seam welded. Watertight joints shall be tested and shall meet the test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS.

2.3.8.4 PVC Plastic Pipes

Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

2.3.8.5 Smooth Wall PE Plastic Pipe

Pipe shall be joined using butt fusion method as recommended by the pipe manufacturer.

2.3.8.6 Corrugated PE Plastic Pipe

Water tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F 477. Soil tight joints shall conform to the requirements in AASHTO-01, Division II, Section 26.4.2.4. (e) for soil tightness and shall be as recommended by the pipe manufacturer.

2.3.8.7 Profile Wall PE Plastic Pipe

Joints shall be gasketed or thermal weld type with integral bell in accordance with ASTM F 894.

2.3.8.8 Ductile Iron Pipe

Couplings and fittings shall be as recommended by the pipe manufacturer.

2.4 STEEL LADDER

Steel ladder shall be provided where the depth of the manhole exceeds 3.66 m (12 feet). These ladders will be not less than 406 mm (16 inches) in width, with 19 mm (3/4 inch) (3/4 inch) diameter rungs spaced 305 mm (12 inches) apart. The two stringers shall be a minimum 9.5 mm (3/8 inch) thick and 63.5 mm (2-1/2 inches) wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123.

2.5 DOWNSPOUT BOOTS

Boots used to connect exterior downspouts to the storm-drainage system shall be of gray cast iron conforming to ASTM A 48, Class 30B or 35B. Shape and size shall be as indicated.

## 2.6 HYDROSTATIC TEST ON WATERTIGHT JOINTS

### 2.6.1 Concrete, Clay, PVC and PE Pipe

A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced and nonreinforced concrete pipe shall conform to AASHTO M 198 or ASTM C 443. Test requirements for joints in clay pipe shall conform to ASTM C 425. Test requirements for joints in PVC and PE plastic pipe shall conform to ASTM D 3212.

### 2.6.2 Corrugated Steel and Aluminum Pipe

A hydrostatic test shall be made on the watertight joint system or coupling band type proposed. The moment strength required of the joint is expressed as 15 percent of the calculated moment capacity of the pipe on a transverse section remote from the joint by the AASHTO-01 (Division II, Section 26). The pipe will be supported for the hydrostatic test so that the joint is located at the point which develops 15 percent of the moment capacity of the pipe based on the allowable span in meters (feet) for the pipe flowing full or 54,233 Newton meters (40,000 foot-pounds), whichever is less. Performance requirements shall be met at an internal hydrostatic pressure of 69 kPa (10 psi) for a 10 minute period for both annular corrugated metal pipe and helical corrugated metal pipe with factory reformed ends.

# PART 3 EXECUTION

## 3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches and for appurtenances and backfilling for culverts and storm drains shall be in accordance with the applicable portions of Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS and the requirements specified below.

### 3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 304 mm (12 inches) to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing where required shall be placed within the trench width as specified. Care shall be taken not to overexcavate. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures shall be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

### 3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 200 mm (8 inches) or 85 mm (1/2 inch) for each meter (foot) of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Government.

## 3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

### 3.2.1 Concrete Pipe

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making the particular type of joint.

### 3.2.2 Clay Pipe

Bedding for clay pipe shall be as specified by ASTM C 12.

### 3.2.3 Corrugated Metal Pipe

Bedding for corrugated metal pipe and pipe arch shall be in accordance with ASTM A 798. It is not required to shape the bedding to the pipe geometry. However, for pipe arches, it is recommended to either shape the bedding to the relatively flat bottom arc or fine grade the foundation to a shallow v-shape. Bedding for corrugated structural plate pipe shall meet requirements of ASTM A 807.

### 3.2.4 Ductile Iron Pipe

Bedding for ductile iron pipe shall be as shown on the drawings.

### 3.2.5 Plastic Pipe

Bedding for PVC and PE pipe shall meet the requirements of ASTM D 2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.

## 3.3 PLACING PIPE

Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to the direct sunlight prior to laying as needed to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed plastic pipe shall not exceed 4.5 percent of the nominal inside diameter. After backfilling has been completed, the Government may perform a deflection test on the entire length of installed plastic pipeline using a mandrel or other suitable device. Any plastic pipe showing deflections in excess of 4.5

percent shall be removed and replaced at the Contractor's expense. All pipe in place shall be inspected before backfilling, and those pipes damaged during placement shall be removed and replaced.

3.3.1 Concrete, Clay, PVC, Ribbed PVC and Ductile Iron Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.3.2 Elliptical and Elliptical Reinforced Concrete Pipe

Placement shall be so that the manufacturer's reference lines designating the top of the pipe will be within 5 degrees of a vertical plane through the longitudinal axis of the pipe. In all backfilling operations, care shall be taken to prevent damage to or misalignment of the pipe.

3.3.3 Corrugated PE Pipe

Laying shall be with the separate sections joined firmly on a bed shaped to line and grade and shall follow manufacturer's recommendations.

3.3.4 Corrugated Metal Pipe and Pipe Arch

Laying shall be with the separate sections joined firmly together, with the outside laps of circumferential joints pointing upstream, and with longitudinal laps on the sides. Part paved pipe shall be installed so that the centerline of bituminous pavement in the pipe, indicated by suitable markings on the top at each end of the pipe sections, coincides with the specified alignment of pipe. Fully paved steel pipe or pipe arch shall have a painted or otherwise applied label inside the pipe or pipe arch indicating sheet thickness of pipe or pipe arch. Any unprotected metal in the joints shall be coated with bituminous material specified in AASHTO M 190 or AASHTO M 243. Interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs shall be used to facilitate moving pipe without damage to exterior or interior coatings. During installation, pipe or pipe arch shall be handled with care to preclude damage to the bituminous coating or paving. Prior to placing backfill, damaged areas of coupling bands and pipe shall be given a coating of bituminous material, specified in AASHTO M 190 or AASHTO M 243. Pipe on which bituminous coating has been damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced. Vertical elongation, where indicated, shall be accomplished by factory elongation. Suitable markings or properly placed lifting lugs shall be provided to ensure placement of factory elongated pipe in a vertical plane.

3.3.5 Structural-Plate Steel Pipe, Pipe Arches, and Arches

Structural plate structures shall be installed in accordance with ASTM A 807. Structural plate shall be assembled in accordance with instructions furnished by the manufacturer. Instructions shall show the position of each plate and the order of assembly. Bolts shall be tightened progressively and uniformly, starting at one end of the structure after all plates are in place. The operation shall be repeated to ensure that all bolts are tightened to meet the torque requirements of 270 Newton meters (200 foot-pounds) plus or minus 68 Newton meters (50 foot-pounds). Any power wrenches used shall be checked by the use of hand torque wrenches or long-handled socket or structural wrenches for amount of torque produced. Power wrenches shall be checked and adjusted frequently as needed, according to type or condition, to ensure proper adjustment to supply the required torque.

3.3.6 Structural-Plate Aluminum Pipe, Pipe Arches, and Arches

Structural plate shall be assembled in accordance with instructions furnished by the manufacturer. Instructions shall show the position of each plate and

the order of assembly. Bolts shall be tightened progressively and uniformly, starting at one end of the structure after all plates are in place. The operation shall be repeated to ensure that all bolts are torqued to a minimum of 136 Newton meters (100 foot-pounds) on aluminum alloy bolts and a minimum of 203 Newton meters (150 foot-pounds) on galvanized steel bolts. Any power wrenches used shall be checked by the use of hand torque wrenches or long-handled socket or structural wrenches for the amount of torque produced. Power wrenches shall be checked and adjusted as frequently as needed, according to type or condition, to ensure that they are in proper adjustment to supply the required torque.

3.3.7 *Omitted*

3.3.8 Jacking Pipe Through Fills

Methods of operation and installation for jacking pipe through fills shall conform to requirements specified in Vol. I, Chapter 8 of AREA-03.

3.4 JOINTS

3.4.1 Concrete and Clay Pipe

3.4.1.1 Cement-Mortar Bell-and-Spigot Joint

The first pipe shall be bedded to the established gradeline, with the bell end placed upstream. The interior surface of the bell shall be carefully cleaned with a wet brush and the lower portion of the bell filled with mortar to such depth as to bring inner surfaces of abutting pipes flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into a bell so that sections are closely fitted. After each section is laid, the remainder of the joint shall be filled with mortar, and a bead shall be formed around the outside of the joint with sufficient additional mortar. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint shall be wrapped or bandaged with cheesecloth to hold mortar in place.

3.4.1.2 Cement-Mortar Oakum Joint for Bell-and-Spigot Pipe

A closely twisted gasket shall be made of jute or oakum of the diameter required to support the spigot end of the pipe at the proper grade and to make the joint concentric. Joint packing shall be in one piece of sufficient length to pass around the pipe and lap at top. This gasket shall be thoroughly saturated with neat cement grout. The bell of the pipe shall be thoroughly cleaned with a wet brush, and the gasket shall be laid in the bell for the lower third of the circumference and covered with mortar. The spigot of the pipe shall be thoroughly cleaned with a wet brush, inserted in the bell, and carefully driven home. A small amount of mortar shall be inserted in the annular space for the upper two-thirds of the circumference. The gasket then shall be lapped at the top of the pipe and driven home in the annular space with a caulking tool. The remainder of the annular space then shall be filled completely with mortar and beveled at an angle of approximately 45 degrees with the outside of the bell. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. Placing of this type of joint shall be kept at least five joints behind laying operations.

3.4.1.3 Cement-Mortar Diaper Joint for Bell-and-Spigot Pipe

The pipe shall be centered so that the annular space is uniform. The annular space shall be caulked with jute or oakum. Before caulking, the inside of the bell and the outside of the spigot shall be cleaned.

a. Diaper Bands: Diaper bands shall consist of heavy cloth fabric to hold grout in place at joints and shall be cut in such lengths that they will extend one-eighth of the circumference of pipe above the spring line on one side of the pipe and up to the spring line on the other side of the pipe. Longitudinal edges of fabric bands shall be rolled and stitched around two pieces of wire. Width of fabric bands shall be such that after fabric has been securely stitched around both edges on wires, the wires will be uniformly spaced not less than 200 mm (8 inches) apart. Wires shall be cut into lengths to pass around pipe with sufficient extra length for the ends to be twisted at top of pipe to hold the band securely in place; bands shall be accurately centered around lower portion of joint.

b. Grout: Grout shall be poured between band and pipe from only the high side of band, until grout rises to the top of band at the spring line of pipe, or as nearly so as possible, on the opposite side of pipe, to ensure a thorough sealing of joint around the portion of pipe covered by the band. Silt, slush, water, or polluted mortar grout forced up on the lower side shall be carefully forced out by pouring and removed.

c. Remainder of Joint: The remaining unfilled upper portion of the joint shall then be filled with mortar and a bead formed around the outside of this upper portion of the joint with a sufficient amount of additional mortar. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind actual laying of pipe. No backfilling around joints shall be done until joints have been fully inspected and approved.

3.4.1.4 Cement-Mortar Tongue-and-Groove Joint

The first pipe shall be bedded carefully to the established gradeline with the groove upstream. A shallow excavation shall be made underneath the pipe at the joint and filled with mortar to provide a bed for the pipe. The grooved end of the first pipe shall be carefully cleaned with a wet brush, and a layer of soft mortar applied to the lower half of the groove. The tongue of the second pipe shall be cleaned carefully with a wet brush; while in horizontal position, a layer of soft mortar shall be applied to the upper half of the tongue. The tongue end of the second pipe then shall be inserted in the grooved end of the first pipe until mortar is squeezed out on interior and exterior surfaces. Sufficient mortar shall be used to fill the joint completely and to form a bead on the outside.

3.4.1.5 Cement-Mortar Diaper Joint for Tongue-and-Groove Pipe

The joint shall be of the type described for cement-mortar tongue-and-groove joint in this paragraph, except that the shallow excavation directly beneath the joint shall not be filled with mortar until after a gauze or cheesecloth band dipped in cement mortar has been wrapped around the outside of the joint. The cement-mortar bead at the joint shall be at least 15 mm (1/2 inch), thick and the width of the diaper band shall be at least 200 mm (8 inches). The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind the actual laying of the pipe. No backfilling around the joints shall be done until the joints have been fully inspected and approved.

3.4.1.6 Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe

Sealing compounds shall follow the recommendation of the particular manufacturer in regard to special installation requirements. Surfaces to receive lubricants, primers, or adhesives shall be dry and clean. Sealing compounds shall be affixed to the pipe not more than 3 hours prior to installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Sealing compounds shall be inspected before installation of the pipe, and any loose or improperly affixed sealing compound shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while

making the joint with mastic-type sealant, a slight protrusion of the material is not visible along the entire inner and outer circumference of the joint when the joint is pulled up, the pipe shall be removed and the joint remade. After the joint is made, all inner protrusions will be cut off flush with the inner surface of the pipe. If nonmastic-type sealant material is used, the "Squeeze-Out" requirement above shall be waived.

3.4.1.7 Flexible Watertight Joints

Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

3.4.1.8 External Sealing Band Joint for Noncircular Pipe

Surfaces to receive sealing bands shall be dry and clean. Bands shall be installed in accordance with manufacturer's recommendations.

3.4.2 Corrugated Metal Pipe

3.4.2.1 Field Joints

Transverse field joints shall be of such design that the successive connection of pipe sections will form a continuous line free of appreciable irregularities in the flow line. In addition, the joints shall meet the general performance requirements described in ASTM A 798. Suitable transverse field joints which satisfy the requirements for one or more of the joint performance categories can be obtained with the following types of connecting bands furnished with suitable band-end fastening devices: corrugated bands, bands with projections, flat bands, and bands of special design that engage factory reformed ends of corrugated pipe. The space between the pipe and connecting bands shall be kept free from dirt and grit so that corrugations fit snugly. The connecting band, while being tightened, shall be tapped with a soft-head mallet of wood, rubber or plastic, to take up slack and ensure a tight joint. The annular space between abutting sections of part paved, and fully paved pipe and pipe arch, in sizes 750 mm (30 inches) or larger, shall be filled with a bituminous material after jointing. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of fill material during the life of the installations. The type, size, and sheet thickness of the band and the size of angles or lugs and bolts shall be as indicated or where not indicated, shall be as specified in the applicable standards or specifications for the pipe.

3.4.2.2 Flexible Watertight, Gasketed Joints

Installation shall be as recommended by the gasket manufacturer for use of lubricants and cements and other special installation requirements. The gasket shall be placed over one end of a section of pipe for half the width of the gasket. The other half shall be doubled over the end of the same pipe. When the adjoining section of pipe is in place, the doubled-over half of the gasket shall then be rolled over the adjoining section. Any unevenness in overlap shall be corrected so that the gasket covers the end of pipe sections equally. Connecting bands shall then be centered over adjoining sections of pipe, and rods or bolts placed in position and nuts tightened. Band

Tightening: The band shall be tightened evenly, even tension being kept on the rods or bolts, and the gasket shall be closely observed to see that it is seating properly in the corrugations. Watertight joints shall remain uncovered for a period of time designated, and before being covered, tightness of the nuts shall be measured with a torque wrench. If the nut has tended to loosen its grip on the bolts or rods, the nut shall be retightened with a torque wrench and remain uncovered until a tight, permanent joint is assured.

## 3.5 DRAINAGE STRUCTURES

### 3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete, plain concrete, brick, precast reinforced concrete, precast concrete segmental blocks, prefabricated corrugated metal, or bituminous coated corrugated metal, complete with frames and covers or gratings and with fixed galvanized steel ladders where indicated. Pipe studs and junction chambers of prefabricated corrugated metal manholes shall be fully bituminous-coated and paved when the connecting branch lines are so treated.

### 3.5.2 Walls and Headwalls

Construction shall be as indicated.

## 3.6 STEEL LADDER INSTALLATION

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 1.83 m (6 feet) vertically, and shall be so installed as to provide at least 152 mm (6 inches) of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

## 3.7 BACKFILLING

### 3.7.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 150 mm (6 inches) in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 300 mm (12 inches) above the top of the pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 152 millimeters (6 inches). Tests for density will be made as necessary to ensure conformance to the compaction requirements specified elsewhere in this paragraph. Where it is necessary in the opinion of the Contracting Officer, any sheeting or portions of bracing used shall be left in place and the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

### 3.7.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified elsewhere in this paragraph. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 150 mm (6 inches) in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 300 mm (12 inches) above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 4 m (12 feet), whichever is less. After the backfill has reached at

least 300 mm (12 inches) above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 152 millimeters (6 inches.

3.7.3 Movement of Construction Machinery

In compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.7.4 Compaction

3.7.4.1 General

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.7.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density (densities) which will be determined as specified in this paragraph.

a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.7.5 Determination of Density

Testing shall be the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved
*3 commercial testing laboratory. ~~or by the Contractor subject to approval.~~ Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM
*3 D 1556. Testing procedures to control compaction and to relate field density data to laboratory test values shall be as specified in Section 02221 EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS, para. TESTING. ~~2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves~~

~~furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017 or ASTM D 2922. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.~~

## 3.8 PIPELINE TESTING

Lines shall be tested for leakage by exfiltration tests. Prior to testing for leakage the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 600 mm (2 feet) or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 600 mm (2 feet) is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed
*2 23.2 liters per mm in diameter per kilometer (250 gallons per inch in diameter per mile) of pipeline per day ~~[0.98 liters per mm in diameter per kilometers (0.2 gallons per inch in diameter per 100 feet) of pipeline per hour].~~ When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correcting, and retesting shall be made at no additional cost to the Government.

-- End of Section --

SECTION 02730

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)

| | |
|---|---|
| AREA-03 | (1994) Manual for Railway Engineering (Fixed Properties): Chapter 1, Roadway and Ballast |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 74 | (1994) Cast Iron Soil Pipe and Fittings |
| ASTM A 123 | (1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products |
| ASTM C 14 | (1995) Concrete Sewer, Storm Drain, and Culvert Pipe |
| ASTM C 33 | (1993) Concrete Aggregates |
| ASTM C 76 | (1995) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe |
| ASTM C 94 | (1995) Ready-Mixed Concrete |
| ASTM C 150 | (1995) Portland Cement |
| ASTM C 260 | (1995) Air-Entraining Admixtures for Concrete |
| ASTM C 270 | (1995a) Mortar for Unit Masonry |
| ASTM C 425 | (1995) Compression Joints for Vitrified Clay Pipe and Fittings |
| ASTM C 443 | (1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets |
| ASTM C 478 | (1994) Precast Reinforced Concrete Manhole Sections |
| ASTM C 478M | (1994) Precast Reinforced Concrete Manhole Sections (Metric) |
| ASTM C 564 | (1995) Rubber Gaskets for Cast Iron Soil Pipe and Fittings |
| ASTM C 700 | (1995) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated |

| | |
|---|---|
| ASTM C 828 | (1990) Low-Pressure Air Test of Vitrified Clay Pipe Lines |
| ASTM C 924 | (1989) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method |
| ASTM C 972 | (1982; R 1990) Test Method for Compression-Recovery of Tape Sealant |
| ASTM D 412 | (1992) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension |
| ASTM D 624 | (1991) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers |
| ASTM D 1784 | (1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds |
| ASTM D 2680 | (1995) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping |
| ASTM D 2751 | (1993) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings |
| ASTM D 2996 | (1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe |
| ASTM D 2997 | (1995) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) Pipe |
| ASTM D 3034 | (1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings |
| ASTM D 3212 | (1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals |
| ASTM D 3262 | (1993) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe |
| ASTM D 3350 | (1993) Polyethylene Plastics Pipe and Fittings Materials |
| ASTM D 3753 | (1981; R 1991) Glass-Fiber-Reinforced Polyester Manholes |
| ASTM D 3840 | (1988) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications |
| ASTM F 402 | (1993) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings |

| | |
|---|---|
| ASTM F 477 | (1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe |
| ASTM F 714 | (1994) Polyethylene (PE) Plastic pipe (SDR-PR) Based on Outside Diameter |
| ASTM F 794 | (1995a) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter |
| ASTM F 894 | (1995) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe |
| ASTM F 949 | (1993a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings |

AMERICAN WATER WORKS ASSOCIATION (AWWA)

| | |
|---|---|
| AWWA C105 | (1988) Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids |
| AWWA C110 | (1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids |
| AWWA C111 | (1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings |
| AWWA C115 | (1988) Flanged Ductile-Iron Pipe with Threaded Flanges |
| AWWA C151 | (1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|---|---|
| NFPA 49 | (1994) Hazardous Chemicals Data |
| NFPA 325M | (1991) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids |
| NFPA 704 | (1990) Identification of the Fire Hazards of Materials |

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

| | |
|---|---|
| UBPPA UNI-B-6 | (1990) Recommended Practice for the Low-Pressure Air Testing of Installed Sewer Pipe |
| UBPPA UNI-B-9 | (1990; Addenda 1994) Recommended Performance Specification for Polyvinyl Chloride (PVC) Profile Wall Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter (Nominal Pipe Sizes 4-48 inch) |

## 1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 1.5 m (5 feet) outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02221EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

## 1.3 *OMITTED*

## 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-13 Certificates

Portland Cement; FIO.

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

Oil Resistant Material; FIO

Certificates of compliance stating that the fittings or gaskets used for waste drains or lines designated on the plans as oil resistant.

# PART 2 PRODUCTS

## 2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

### 2.1.1 Concrete Pipe

Concrete pipe 600 mm (24 inches) or less in diameter, unless otherwise shown or specified, shall be nonreinforced and conform to ASTM C 14, Class 2. Concrete pipe greater than 600 mm (24 inches) in diameter shall be reinforced and conform to ASTM C 76, Class III. Pipe less than 900 mm (36 inches) in diameter shall be bell and spigot type. Pipe 900 mm (36 inches) or greater in diameter shall be bell and spigot type, tongue and groove type, or modified tongue and groove type.

### 2.1.2 Plastic Pipe

Acrylonitrile-butadiene-styrene (ABS) and polyvinyl chloride (PVC) composite sewer piping shall conform to ASTM D 2680. Size 200 mm (8-inch) through 380 mm (15-inch) diameter.

2.1.2.1 ABS Pipe

ASTM D 2751.

2.1.2.2 PVC Pipe

ASTM D 3034, Type PSM with a maximum SDR of 35, Size 380 mm (15 inches) or less in diameter. ASTM F 949 for corrugated sewer pipes with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior, size 200 mm (8-inch) through 1200 mm (48-inch) diameters. PVC shall be certified by the compounder as meeting the requirements of ASTM D 1784, cell Class 12454B. The pipe stiffness shall be greater than or equal to 735/D for cohesionless material pipe trench backfills.

2.1.2.3 High Density Polyethylene Pipe

ASTM F 894, Class 63, size 450 mm (18-inch) through 3000 mm (120 inch). ASTM F 714, size 100 mm (4-inch) through 1200 mm (48-inch). The polyethylene shall be certified by the resin producer as meeting the requirements of ASTM D 3350, cell Class 334433C. The pipe stiffness shall be greater than or equal to 1170/D for cohesionless material pipe trench backfills.

2.1.3 Reinforced Plastic Mortar Pipe (RPMP)

ASTM D 3262.

2.1.4 Reinforced Thermosetting Resin Pipe (RTRP)

ASTM D 3262.

2.1.4.1 Filament Wound RTRP-I

RTRP-I shall conform to ASTM D 2996, except pipe shall have an outside diameter equal to cast iron outside diameter or standard weight steel pipe. The pipe shall be suitable for a normal working pressure of 1.03 MPa (150 psi) at 22.8 degrees C (73 degrees F). The inner surface of the pipe shall have a smooth uniform continuous resin-rich surface liner conforming to ASTM D 2996.

2.1.4.2 Centrifugally Cast RTRP-II

RTRP-II shall conform to ASTM D 2997. Pipe shall have an outside diameter equal to standard weight steel pipe.

2.1.5 Ductile Iron Pipe

Pipe shall conform to AWWA C151 unless otherwise shown or specified.

2.1.6 Cast Iron Soil Pipe

ASTM A 74, Class SV.

2.1.7 Clay Pipe

ASTM C 700. Where indicated, pipe shall be acid resistant.

2.2 FITTINGS

Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below.

2.2.1 Concrete Pipe

ASTM C 14 for pipe 600 mm (24 inches) or less in diameter. ASTM C 76 for pipe greater than 600 mm (24 inches) in diameter.

2.2.2 Plastic Pipe

ABS and PVC composite sewer pipe fittings shall conform to ASTM D 2680.

2.2.2.1 ABS Pipe

ASTM D 2751.

2.2.2.2 PVC Pipe

ASTM D 3034 for type PSM pipe. ASTM F 949 for corrugated sewer pipe with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior.

2.2.2.3 High Density Polyethylene Pipe

ASTM F 894.

2.2.3 RPMP

ASTM D 3840.

2.2.4 RTRP

ASTM D 3262.

2.2.5 Ductile Iron Pipe

Mechanical fittings shall conform to AWWA C110, rated for 1.03 MPa (150 psi). Push-on fittings shall conform to AWWA C110 and AWWA C111, rated for 10.3 MPa (150 psi).

2.2.6 Cast Iron Soil Pipe

ASTM A 74.

2.2.7 Clay Pipe

ASTM C 700 Extra strength.

2.3 JOINTS

Joints installation shall comply with the manufacturer's instructions. Fittings and gaskets utilized for waste drains or industrial waste lines shall be certified by the manufacturer as oil resistant.

2.3.1 Concrete Pipe

Joints and gaskets shall conform to ASTM C 443.

2.3.2 Plastic Pipe

Flexible plastic pipe (PVC or high density polyethylene pipe) gasketed joints shall conform to ASTM D 3212.

2.3.2.1 ABS Pipe

ASTM D 2751, solvent weld or bell and spigot O-ring joint, size 300 mm (12 inches) or less in diameter, dimensions and tolerances in accordance with Table 2 therein.

2.3.2.2 High Density Polyethylene Pipe

Rubber gasket joints shall conform to ASTM C 443.

2.3.3 RPMP

Joints shall be bell and spigot type utilizing an elastomeric gasket in accordance with ASTM F 477.

2.3.4 RTRP

Joints shall be bell and spigot type utilizing an elastomeric gasket in accordance with ASTM F 477.

2.3.5 Ductile Iron Pipe

Push-on joints shall conform to AWWA C111. Mechanical joints shall conform to AWWA C111 as modified by AWWA C151. Flanged joints shall conform to AWWA C115.

2.3.6 Cast Iron Soil Pipe

Rubber gaskets for compression joints shall conform to ASTM C 564. Packing material for caulked joints shall be twisted jute or oakum, tarred type, or asphalt-saturated cellulose-fiber. Joints for acid resisting cast iron soil pipe shall be made with acid resistant non-asbestos packing. The packing shall contain no material which would affect adhesion of the joint sealing material to the pipe. Lead shall be suitable for caulking of joints.

2.3.7 Clay Pipe

Compression joints shall conform to ASTM C 425.

2.4 BRANCH CONNECTIONS

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

2.5 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type as suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 181.4 kg (400 pounds). Reinforced concrete frames and covers shall be as indicated or shall conform to ASTM C 478 or ASTM C 478M. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.6 STEEL LADDER

A steel ladder shall be provided where the depth of a manhole exceeds 3.6 m (12 feet). The ladder shall not be less than 406.4 mm (16 inches) in width, with 19.1 mm (3/4 inch) diameter rungs spaced 304.8 mm (12 inches) apart. The two stringers shall be a minimum 9.5 mm (3/8 inch) thick and 50.8 mm (2 inches) wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123.

## 2.7 CEMENT MORTAR

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

### 2.7.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type II for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking. Where aggregates are alkali reactive, as determined by Appendix XI of ASTM C 33, a cement containing less than 0.60 percent alkalies shall be used.

### 2.7.2 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94, compressive strength of 28 MPa (4,000 psi) at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 17 MPa (2,500 psi) minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

## 2.8 STRUCTURES

### 2.8.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478, except that portland cement shall be as specified herein. Joints shall be cement mortar, an approved mastic, rubber gaskets, a combination of these types; or the use of external preformed rubber joint seals and extruded rolls of rubber with mastic adhesive on one side.

### 2.8.2 Glass-Fiber Reinforced Polyester Manholes

Glass-fiber-reinforced polyester manholes shall conform to ASTM D 3753.

# PART 3 EXECUTION

## 3.1 INSTALLATION

### 3.1.1 Adjacent Facilities

#### 3.1.1.1 Water Lines

Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be closer horizontally than 3 m (10 feet) to a water-supply main or service line, except that where the bottom of the water pipe will be at least 300 mm (12 inches) above the top of the sewer pipe, the horizontal spacing may be a minimum of 2 m (6 feet). Where gravity-flow sewers cross above water lines, the sewer pipe for a distance of 3 m (10 feet) on each side of the crossing shall be fully encased in concrete or shall be acceptable pressure pipe with no joint closer horizontally than 1 m (3 feet) to the crossing. The thickness of the concrete encasement including that at the pipe joints shall be not less than 100 mm (4 inches).

3.1.1.2 Roads, Railroads, and Airfields

Water pipe shall be encased in a sleeve of rigid conduit for the lengths shown. Where sleeves are required, the pipe sleeve shall be as specified for storm drains in Section 02720 STORM-DRAINAGE SYSTEM. A minimum clearance of at least 50 mm (2 inches) between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Sand bedding shall be provided for the water pipe through the sleeve. Sleeves of ferrous material shall be provided with the corrosion protection as required for the conditions encountered at the site of installation.

3.1.1.3 Structures

Where sewer pipe is to be installed within 1 m (3 feet) of an existing or proposed building or structural foundation such as a retaining wall, control tower footing, water tank footing, or any similar structure, the sewer pipe shall be sleeved as specified above. Care shall be exercised and proper precautions taken during installation of the sewer pipe and sleeve to assure that there will be no damage to such structures and no settlement or movement of foundations or footing.

3.1.2 Pipe Laying

a. Pipe shall be protected during handling against impact shocks and free fall and the pipe interior shall be free of extraneous material.

b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.

c. Before making pipe joints all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.

d. ABS composite pipe ends with exposed truss and filler material shall be coated with solvent weld material before making the joint to prevent water or air passage at the joint between the inner and outer wall of the pipe.

e. Installations of solvent weld joint pipe, using ABS or PVC pipe and fittings shall be in accordance with ASTM F 402. All required precautions shall be taken to assure adequate trench ventilation and protection for workers installing the pipe.

3.1.2.1 Caulked Joints

The packing material shall be well packed into the annular space to prevent the entrance of lead into the pipe. The remainder of the space shall be filled with molten lead that is hot enough to show a rapid change in color when stirred. Scum shall be removed before pouring. The lead shall be caulked to form a tight joint without overstraining the bell and shall have a minimum depth of 25 mm (1 inch) after caulking.

3.1.2.2 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not

in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

3.1.2.3 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

3.1.2.4 Width of Trench

If the maximum width of the trench at the top of the pipe, as specified in
*3 Section 02222 EXCAVATION, FILLING, AND BACKFILLING FOR UTILITY SYSTEMS, ~~02221 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS~~, is exceeded for any reason other than by direction, the Contractor shall install at no additional cost to the Government such concrete cradling, pipe encasement, or other bedding required to support the added load of the backfill.

3.1.2.5 Joints

Joints between different pipe materials shall be made as specified, using approved jointing materials.

3.1.2.6 Handling and Storage

Pipe, fittings and joint material shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities for plastic pipe, fittings, joint materials and solvents shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325M.

3.1.3 Leakage Tests

Lines shall be tested for leakage by low pressure air testing, infiltration tests or exfiltration tests, as appropriate. Low pressure air testing for vitrified clay pipes shall be as prescribed in ASTM C 828. Low pressure air testing for concrete pipes shall be as prescribed in ASTM C 828. Low pressure air testing for PVC pipe shall be as prescribed in UBPPA UNI-B-6. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C 828 and ASTM C 924, after consultation with the pipe manufacturer. Prior to infiltration or exfiltration tests the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 600 mm (2 feet) or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. When the Contracting Officer determines that infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so that a head of at least 600 mm (2 feet) is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established.

The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed per kilometer 600 liters per 10 mm
*2 diameter per kilometer (250 gallons per inch diameter per mile) of pipeline per day [~~50 mL per 5 mm diameter per 100 meters (0.2 gallons per inch diameter~~

~~per 100 feet) of pipeline per hour]~~. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Government.

3.1.4 Test for Deflection

When flexible pipe is used, a deflection test shall be made on the entire length of the installed pipeline not less than 30 days after the completion of all work including the leakage test, backfill, and placement of any fill, grading, paving, concrete, or superimposed loads. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. The ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 92.5 percent of the inside diameter of the pipe, but 95 percent for RPMP and RTRP. A tolerance of plus 0.5 percent will be permitted. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 4.0 degrees C (39.2 degrees F), and shall have a surface brinell hardness of not less than 150. It shall be center bored and through bolted with a 6.4 mm (1/4 inch) minimum diameter steel shaft having a yield strength of 480 MPa (70,000 psi) or more, with eyes at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer such that a pull exerted on the opposite end of the shaft shall produce compression throughout the remote end of the ball, cylinder or circular section. Circular sections shall be so spaced that the distance from the external faces of the front and back sections shall equal or exceed the diameter of the circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through or by being flushed through with water, shall be cause for rejection of that run. When a deflection device is used for the test in lieu of the ball, cylinder, or circular sections described, such device shall be approved prior to use. The device shall be sensitive to 1.0 percent of the diameter of the pipe being measured and shall be accurate to 1.0 percent of the indicated dimension. Installed pipe showing deflections greater than 7.5 percent of the normal diameter of the pipe, or 5 percent for RTRP and RPMP, shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

3.2 CONCRETE CRADLE AND ENCASEMENT

The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

3.3 WYE BRANCHES

Wye branches shall be installed where sewer connections are indicated or where directed. Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

3.4 MANHOLES

### 3.4.1 General

Manholes shall be constructed of glass-fiber-reinforced polyester, prefabricated plastic, concrete, or precast concrete manhole sections. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe connections shall be made to manhole using water stops, standard O-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's recommendation. The Contractor's proposed method of connection, list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 100 mm per meter (1 inch per foot) nor more than 200 mm per meter (2 inches per foot). Free drop inside the manholes shall not exceed 500 mm (1 foot 6 inches), measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels, and drop manholes shall be constructed whenever the free drop would otherwise be greater than 500 mm (1 foot 6 inches).

### 3.4.2 Steel Ladder

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 1850 mm (6 feet) apart vertically, and shall be installed to provide at least 150 mm (6 inches) of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

### 3.4.3 Jointing, Plastering and Sealing

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer. Precast rings may also be sealed by the use of extruded rolls of rubber with mastic adhesive on one side.

### 3.4.4 Frames and Covers

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 50 mm (2 inches) higher than finished grade in unpaved areas. Frame and cover assemblies shall be sealed to manhole sections using external preformed rubber joint seals that meet the requirements of ASTM D 412 and ASTM D 624, or other methods specified in paragraph Jointing, Plastering and Sealing, unless otherwise specified.

### 3.4.5 External Preformed Rubber Joint Seals

External preformed rubber joint seals and extruded rolls of rubber with mastic adhesive shall meet the requirements of ASTM D 412 and ASTM C 972 to ensure conformance with paragraph Leakage Tests. The seal shall be multi-section with neoprene rubber top section and all lower sections made of Ethylene Propylene Di Monomer (EPDM) rubber with a minimum thickness of 1.5 mm (60 mils). Each unit shall consist of a top and a bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be non-hardening butyl rubber sealant and

shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. One unit shall seal a casting and up to six, 50 mm (2-inch) adjusting rings. The bottom section will be 305 mm (12 inches) in height. A 152 mm (6-inch) high top section will cover up to two, 50 mm (2-inch) adjusting rings. A 305 mm (12-inch) high bottom section will cover up to six, 50 mm (2-inch) adjusting rings. Extension sections shall cover up to two more adjusting rings. Each extension shall overlap the bottom section by 50 mm (2 inches) and shall be overlapped by the top section by 50 mm (2 inches).

## 3.5 CONNECTIONS TO EXISTING MANHOLES

Pipe connections to existing manholes shall be made in such manner that the finish work will conform as nearly as practicable to the essential applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1-1/2 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

## 3.6 BUILDING CONNECTIONS

Building connections shall include the lines to and connection with the building waste drainage piping at a point approximately 1.5 m (5 feet) outside the building, unless otherwise indicated. Where building drain piping is not installed, the Contractor shall terminate the building connections approximately 1.5 m (5 feet) from the site of the building at a point and in a manner designated.

## 3.7 CLEANOUTS AND OTHER APPURTENANCES

Cleanouts and other appurtenances shall be installed where shown on the drawings or as directed by the Contracting Officer, and shall conform to the detail of the drawings.

End of Section

SECTION 02811

UNDERGROUND SPRINKLER 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 the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 53 | (1990b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless |
| ASTM B 32 | (1993) Solder Metal |
| ASTM B 43 | (1991) Seamless Red Brass Pipe, Standard Sizes |
| ASTM B 88 | (1993) Seamless Copper Water Tube |
| ASTM D 1785 | (1991) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 |
| ASTM D 2241 | (1989) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) |
| ASTM D 2287 | (1992) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds |
| ASTM D 2464 | (1991) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 |
| ASTM D 2466 | (1990a) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 |
| ASTM D 2564 | (1991a) Solvent Cements for Chloride) (PVC) Plastic Piping Systems |
| ASTM D 2774 | (1972; R 1983) Underground Installation of Thermoplastic Pressure Piping |
| ASTM D 2855 | (1990) Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings |
| ASTM D 3261 | (1990) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing |
| ASTM F 441 | (1989) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80 |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|---|---|
| ASME A112.26.1M | (1984) Water Hammer Arresters |

ASME B1.2 (1983; R 1991; Errata May 1992) Gages and Gaging for Unified Inch Screw Threads

ASME B16.3 (1992) Malleable Iron Threaded Fittings,Classes 150 and 300

ASME B16.15 (1985) Cast Bronze Threaded Fittings Classes 125 and 250

ASME B16.18 (1984) Cast Copper Alloy Solder Joint Pressure Fittings

ASME B16.22 (1989) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1012 (1978) Backflow Preventers with Intermediate Atmospheric Vent

ASSE 1013 (1988) Reduced Pressure Principle Backflow Preventers

ASSE 1020 (1989) Pressure Vacuum Breaker Assembly (Recommended for Outdoor Usage)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C509 (1987) Resilient-Seated Gate Valves for Water and Sewerage Systems

AWWA C901 (1988; Errata 1988) Polyethylene (PE) Pressure Pipe and Tubing, ½ In. Through 3 In., for Water Service

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-51145 (Rev C) Flux, Soldering, Non-Electronic,Paste & Liquid

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCHR)

FCCHR-01 (1988) Manual of Cross-Connection Control

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80 (1987) Bronze Gate, Globe, Angle and Check Valves

MSS SP-85 (1985) Cast Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (1988; Rev 1) Industrial Control Devices, Controllers and Assemblies

NEMA ICS 6 (1988; Rev 1) Enclosures for Industrial Control and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1993) National Electrical Code

1.2 PERFORMANCE REQUIREMENTS

1.2.1 Contractor shall furnish labor, materials, equipment and services necessary to properly and completely install a complete, fully operational sprinkler system asdescribed on Drawings, fully warranted and free of defects for 12 consecutive months after acceptance. The Work shall include, but shall not be limited to the following:

a. Verify underground utility locations.

b. Coordinate work of this section with work of related trades and subcontractors to assure smooth progression of work.

c. Protect remaining existing features and the improvements described on the architectural and site construction plans. Repair damage at Contractor's expense.

d. Trenching and backfilling for all pipes, valves, and eipmentspecified. Tamping of all trenches to the compaction specified.

e. Furnishing and installing all meters, backflow prevention devices, mains, laterals, fittings, valve boxes, control valves, electric wire, heads, manual valves, etc., and all necessary permits, fees, specialties and accessories as required for a complete system.

f. Cutting and trimming sod around all sprinkler heads and equipment.

g. Testing of irrigation system.

h. Regulating and adjusting all emitters, time sequence control devices and section valves.

I. Maintenance as defined in Article 1.03 of this Section.

j. Submission of required documents, and required maintenance during warranty period.

*3 1.2.2 ~~Contractor~~ System shall operate with a minimum water pressure of 60 psi at connection to main and 40 psi at the last head in each zone.

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

Framed Instructions; FIO.

Labels, signs, and templates of operating instructions that are required to be mounted or installedon the wall beside the automatic controller for normal, safe operation.

Design Analysis and Calculations; FIO. Spare Parts; FIO.

Design analyses and pressure calculations verifying that system will provide the irrigation requirements. Spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later

than the start of the field tests. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Sprinkler System; FIO.

Detail drawings for valves, sprinkler heads, backflow preventers, automatic controllers, emitter heads, and water hammer arresters. Drawing shall include of a complete list of equipment and materials, and manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed system layout, type and number of heads and emitters, zone valves, drain pockets, backflow devices, controllers, and mounting details of controllers. As-built Drawings which provide current factual information showing locations of mains, heads, valves, and controllers including deviations from and amendments to the drawings and changes in the work shall be included.

SD-06 Instructions

Sprinkler System; FIO.

Detailed procedures defining the Contractor's provisions for accident prevention, health protection, and other safety precautions for the work to be done.

SD-09 Reports

Field Tests; FIO.

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of control valves.

SD-13 Certificates

Sprinkler System; FIO.

The material supplier's or equipment manufacturer's statement that the supplied material or equipment meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of material supplier or product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply.

SD-19 Operation and Maintenance Manuals

Sprinkler System; FIO.

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set prior to field testing and the remainder upon acceptance. Manuals shall be approved prior to the field training course. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be protected from the weather; excessive humidity and temperature variation; direct sunlight (in the case of plastic or rubber materials); and dirt, dust, or other contaminants.

1.5 FIELD MEASUREMENTS

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer who has produced similar systems which have performed well for a minimum period of 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Nameplates

Each item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.3 Extra Stock

The following extra stock shall be provided: Two sprinkler heads of each size and type, two valve keys for operating manual valves, two wrenches for removing and installing each type of head, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

2.2 PIPING MATERIALS

2.2.1 Copper Tubing and Associated Fittings

2.2.1.1 Tubing

Tubing shall conform to requirements of ASTM B 88, Type K.

2.2.1.2 Fittings

Fittings shall conform to ASME B16.22 and ASME B16.18, solder joint. Solder shall
conform to ASTM B 32 95-5 tin-antimony. Flux shall conform to CID A-A-51145, Type I.

2.2.2 Red Brass Pipe and Associated Fittings

2.2.2.1 *Omitted*
2.2.2.2 *Omitted*

2.2.3 Galvanized Steel Pipe and Associated Fittings

2.2.3.1 Pipe

Pipe shall conform to requirements of ASTM A 53, Schedule 40.

2.2.3.2 Fittings

Fittings shall be Class 150 conforming to requirements of ASME B16.3.

2.2.4 Polyvinyl Chloride (PVC) Pipe, Fittings and Solvent Cement

2.2.4.1 Pipe

*2 Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40 ~~[80]~~; or ASTM D 2241, PVC 1120 SDR 21, Class 200.

2.2.4.2 Fittings

Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded type fittings shall conform to requirements of ASTM D 2464, Schedule 80.

2.2.4.3 Solvent Cement

Solvent cement shall conform to the requirements of ASTM D 2564.

2.3 SPRINKLER AND EMITTER HEADS

2.3.1 Pop-Up Spray Heads

Pop-up spray heads lay flush with housing, then pop up when water pressure 138 kPa (20 psi) is activated in system. The rising member supporting the nozzle shall be identical on full, half, third or quarter pattern sprinklers so that nozzles will be interchangeable. The sprinkler head shall be designed to be adjustable for coverage and flow. The nozzle shall be removable so head does not have to be removed for flushing or cleaning. Nozzle rises a minimum of 100 mm (4 inches) (4 inches) above the body. The body shall be constructed with a 13 mm (1/2 inch) female thread for installation in a fixed underground pipe system.

2.3.1.1 Shrubbery Sprinkler Heads

Sprinkler heads shall be conical spray with adjustable or non-adjustable coverage and designed for permanent aboveground mounting on riser or pop-ups at a height compatible with ground covers. Provide brass nozzles.

2.3.2 Rotary Pop-Up Sprinklers

Sprinklers shall be capable of covering the designated spray pattern shown on the Plans with the specified application rate, at the specified pressure, gallons per minute, and trajectory as specified in the submitted manufacturer’s equipment manual. Construction shall be high impact molded plastic with filter screen, reducible watering radius, andspecified nozzle and have adjustable radius capabilities.

2.4 VALVES

2.4.1 Gate Valves, Less than 80 mm (3 Inches)

Gate valves shall conform to the requirements of MSS SP-80, Type 1, Class 150, threaded ends.

2.4.2 Gate Valves, 80 mm (3 Inches) and Larger

Gate valves shall conform to the requirements of AWWA C509 and have encapsulated resilient wedge, parallel seats, non-rising stems, and open by counterclockwise turning. End connections shall be flanged. Interior construction of valves

shall be bronze including stem containing a maximum 2 percent aluminum and maximum 16 percent zinc.

2.4.3 Angle Valves, Less Than 65 mm (2-1/2 Inches)

Angle valves shall conform to the requirements of MSS SP-80, Type 3, Class 150, threaded
ends.

2.4.4 Angle Valves, 65 mm (2-1/2 Inches) (2-1/2 Inches) and Larger

Angle valves shall conform to the requirements of MSS SP-85, Type II, Class 250, threaded
ends.

2.4.5 *Omitted*

2.4.6 Remote Control Valves, Electrical

Remote control valves shall be solenoid actuated globe valves of 20 to 80 mm (3/4 to 3 inch) (3/4 to 3 inch) size, suitable for 24volts, 60 cycle, and designed to provide for shut-off in event of power failure. Valve shall be cast bronze or brass or plastic housing suitable for service at 1034 kPa (150 psi) (150 psi) operating pressure with external flow control adjustment for shut-off capability, external plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

2.4.8 Pressure Regulating Master Valve

Pressure regulating master valve shall be automatic mechanical self-cleaning, self-purging control system having an adjustable pressure setting operated by a solenoid on alternating current with 0.70 amperes at 24 volts. Valve shall close slowly and be freeof chatter in each diaphragm position, have manual flow stem to adjust closing speed and internal flushing, and two inlet tappings capable of being installed as a straight pattern valve. Body shall be cast bronze or brass with removable brass seat serviceable from top without removing valve body from system. Valve shall operate at 1034 kPa (150 psi) (150 psi) working pressure and pilot
range from 70 to 875 kPa (10 to 125 psi). (10 to 125 psi.).

2.4.9 Backflow Preventers

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 be in accordance with ASSE 1012. Reduced pressure principle backflow preventers shall be in accordance with ASSE 1013.

2.4.9.1 *Omitted*

2.4.9.2 Reduced Pressure Type Backflow Preventers

Backflow preventers shall be Class 150, flanged, brass mounted gate valve and strainer, 304 stainless steel or bronze, internal parts. Total pressure drop through complete assembly shall be a maximum of 70 kPa (10 psi) (10 psi) at rated flow. Piping shall be galvanized steel pipe and fittings. Strainers shall be bronze or brass construction with gasket caps. Units shall have 200-mesh stainless steel screen elements.

## 2.5 ACCESSORIES AND APPURTENANCES

### 2.5.1 Valve Keys for Manually Operated Valves

Valve keys shall be 15 mm (1/2 inch) (1/2 inch) diameter by 1000 mm (3 feet) long, tee handles and keyed to fit valves.

### 2.5.2 Valve Boxes and Concrete Pads

#### 2.5.2.1 Valve Boxes

Valve boxes shall be cast iron, plastic lockable, or precast concrete for each gate valve, manual control valve and remote control valve. Box sizes shall be adjustable for valve used. Word "IRRIGATION" shall be cast on cover. Shaft diameter of box shall be minimum 130 mm (5-1/4 inches). (5-1/4 inches.) Cast iron box shall have bituminous coating.

### 2.5.3 Pressure Gauges

Pressure gauges shall conform to requirements of ASME B40.1, single style pressure gauge for water with 115 mm (4-1/2 inch) (4-1/2 inch) dial brass or aluminum case, bronze tube, gauge cock, pressure snubber, and siphon. Scale range shall be suitable for irrigation sprinkler systems.

### 2.5.4 Service Clamps

Service clamps shall be bronze flat, double strap, with neoprene gasket or "O"-ring seal.

## 2.6 AUTOMATIC CONTROLLERS, ELECTRICAL

Controller shall conform to the requirements of NEMA ICS 2 with 120-volt single phase service, operating with indicated stations, and grounded chassis. Enclosure shall conform to NEMA ICS 6 Type 3R, with locking hinged cover, wall-mounted. Controller shall be programmed for various schedules by setting switches and dials equipped with the following features: A switch for each day of week for two schedules, allowing each station to be scheduled individually as to days of watering; a minute switch for each station with a positive increment range of 3 to 60 minutes, set time within one percent; a switch allowing selected schedules to be repeated after each completion of initial watering schedule and allowing each
operation to be scheduled throughout a 24-hour day; a circuit breaker for surge protection; and circuit for a 9-volt rechargeable NiCad battery.

## 2.7 ELECTRICAL WORK

Wiring and rigid conduit for electrical power shall be in accordance with NFPA 70, and Section 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

## 2.8 *OMITTED*

## 2.9 WATER SUPPLY MAIN MATERIALS

Tapping sleeves, service cut off valves, and connections to water supply mains shall be in accordance with Section 02660, WATER LINES.

## 2.10 INSULATING JOINTS

Insulating joints and dielectric fittings shall be in accordance with Section 02660, WATER LINES.

PART 3 EXECUTION

3.1 INSTALLATION

Sprinkler system shall be installed after site grading has been completed. Excavation, trenching, and backfilling for sprinkler system shall be in accordance with the applicable provisions of Section 02222, EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

3.1.1 Trenching

Trench around roots shall be hand excavated to pipe grade when roots of 50 mm (2 inches) diameter or greater are encountered. Trench width shall be 100 mm (4 inches) minimum or 1-1/2 times diameter of pipe, whichever is wider. Backfill shall be hand tamped over excavation. When rock is encountered, trench shall be excavated 100 mm (4 inches) deeper and backfilled with silty sand (SM) or well-graded sand (SW) to pipe grade. Trenches shall be kept free of obstructions and debris that would damage pipe. Subsoil shall not be mixed with topsoil. Existing concrete walks, drives and other obstacles shall be bored at a depth conforming to bottom of adjacent trenches. Pipe sleeves for bored pipe shall be two pipe diameters larger than sprinkler pipe.

3.1.2 Piping System

3.1.2.1 Cover

Underground piping shall be installed as to meet the minimum depth of backfill cover specified.

3.1.2.2 Clearances

Minimum horizontal clearances between lines shall be 100 mm (4 inches) for pipe 50 mm (2 inches) (2 inches) and less; 300 mm (12 inches) for 65 mm (2-1/2 inches) (2-1/2 inches) and larger. Minimum vertical clearances between lines shall be 25 mm. (1 inch.)

3.1.2.3 Minimum Slope

Minimum slope shall be 50 mm (6 inches) per 10 m (100 feet) in direction of drain valves.

3.1.3 Piping Installation

3.1.3.1 Polyvinyl Chloride (PVC) Pipe

a. Solvent-cemented joints shall conform to the requirements of ASTM D 2855.

b. Threaded joints shall be full cut with a maximum of three threads remaining exposed on pipe and nipples. Threaded joints shall be made tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.

c. Piping shall be joined to conform with requirements of ASTM D 2774 or ASTM D 2855, and pipe manufacturer's instructions. Pipe shall be installed in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Pipes shall be installed at temperatures over 5 degrees C. (40 degrees F.)

3.1.3.2 Soldered Copper Tubing

Pipe shall be reamed and burrs removed. Contact surfaces of joint shall be cleaned and polished. Flux shall be applied to male and female ends. End of

tube shall be inserted into fittings full depth of socket. After soldering, a solder bead shall show continuously around entire joint circumference. Excess acid flux shall be removed from tubings and fittings.

3.1.3.3 Threaded Brass or Galvanized Steel Pipe

Prior to installation, pipe shall be reamed. Threads shall be cut in conformance with ASME B1.2. Pipe joint compound shall be applied to male end only.

3.1.3.4 Insulating Joints

Insulating and dielectric fittings shall be provided where pipes of dissimilar metal are joined and at connections to water supply mains as shown. Installation shall be in accordance with Section 02660, WATER LINES.

3.1.4 Valves

3.1.4.1 Manual Valves

Valves shall be installed in a valve box extending from grade to below valve body, with a minimum of 100 mm (4 inches) cover measured from finish grade to top of valve stem.

3.1.4.2 *Omitted*

3.1.4.3 Drain Valves

Entire system shall be manually or automatically drainable. Low points of system shall be equipped with drain valve draining into an excavation containing 0.03 cubic meter (1 cubic foot) gravel. Gravel shall be covered with building paper then backfilled with excavated material and 150 mm (6 inches) of topsoil.

1.5 Sprinklers and Quick Coupling Valves

Sprinklers and valves shall be installed plumb and level with terrain.

3.1.6 Installation of Drip Irrigation System

*Omitted*

3.1.7 Backflow Preventers

Backflow preventer shall be installed in new connection to existing water distribution system, between connection and control valves. Backflow preventer shall be installed with concrete pads.

3.1.7.1 *Omitted*

3.1.7.2 Reduced Pressure Type

Reduced pressure type shall be installed as follows: Flush pipe lines prior to installing device and protect device by a strainer located upstream. Device shall not be installed in pits or where any part of device could become submerged in standing water.

3.1.8 Control Wire and Conduit

3.1.8.1 Wires

Low voltage wires shall be buried beneath pipe in same trench. Rigid conduit shall be provided where wires run under paving. Wires shall be number tagged at

key locations along main to facilitate service, and shall be taped to underside of pipe every 20 feet. One control circuit shall be provided for each zone, one circuit to control sprinkler system, and two spare circuits shall be provided.

3.1.8.2 Loops

A 300 mm (12 inch) loop of wire shall be provided at each valve where controls are
connected.

3.1.8.3 Expansion and Contraction

Multiple tubes or wires shall be bundled and taped together at 6 m (20 foot) intervals with 300 mm (12 inch) loop for expansion and contraction.

3.1.8.4 Splices

Electrical splices shall be waterproof.

3.1.9 Automatic Controller

Exact field location of controllers shall be determined before installation. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

3.1.10 Thrust Blocks

Concrete shall be placed so that sides subject to thrust or load are against undisturbed earth, and valves and fittings are serviceable after concrete has set. Thrust blocks shall be as specified in Section 02660, WATER LINES.

3.1.11 Backfill

3.1.11.1 Minimum Cover

Depth of cover shall be 600mm (24 inches) for all mainline piping; and 450 mm (18 inches) for all lateral piping line; 1000 (36 inches) for pipes under traffic loads, farm operations, and freezing temperatures; and 300mm (12 inches) for low-voltage wires. Remainder of trench or pipe cover shall be filled to within 80 mm (3 inches) of top with excavated soil, and compact soil with plate mechanized compactors to same density as undisturbed adjacent soil.

3.1.11.2 Restoration

*3 Top 80 mm (3 inches) shall be filled with topsoil and compacted with same density as surrounding soil. Pavements shall be restored in accordance with Section ~~02510~~ 02511 and 02550.

3.1.12 Adjustment

After grading, seeding, and rolling of planted areas, sprinkler heads shall be adjusted flush with finished grade. Adjustments shall be made by providing new nipples of proper length or by use of heads having an approved device, integral with head, which will permit adjustment in height of head without changing piping.

3.1.13 Disinfection

Sprinkler system fed from a potable water system shall be disinfected upstream of backflow preventer in accordance with Section 02660, WATER LINES.

3.1.14 Cleaning of Piping

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by Contracting Officer.

## 3.2 FIELD TESTS

All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor.

### 3.2.1 Hydrostatic Pressure Test

Piping shall be tested hydrostatically before backfilling and proved tight at a hydrostatic pressure of 1034 kPa (150 psi) (150 psi) without pumping for a period of four hours with an allowable pressure drop of 35 kPa (5 psi). (5 psi.) If hydrostatic pressure cannot be held for a minimum of 4 hours, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer.

### 3.2.2 *Omitted*

### 3.2.3 Operation Test

At conclusion of pressure test, sprinkler heads or emitter heads, quick coupling assemblies, and hose valves shall be installed and entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be sprinkled.

## 3.3 POSTING FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system. After as-built drawings are approved by Contracting Officer, controller charts and programming schedule shall be prepared. One chart for each controller shall be supplied. Chart shall be a reduced drawing of actual as-built system that will fit the maximum dimensions inside controller housing. Black line print for chart and a different pastel or transparent color shall indicate each station area of coverage. After chart is completed and approved for final acceptance, chart shall be sealed between two 0.505 mm (20 mil) (20 mil) pieces of clear plastic.

## 3.4 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 2 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals.

## 3.5 CLEANUP

Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

SECTION 02935

TURF

PART 1 GENERAL

Turf establishment shall be consist of establishing all disturbed areas with sod as designated on the Drawings.

1.1 REFERENCES

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

AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01 (Amended thru: Aug 1988) Federal SeedAct Regulations (Part 201-202)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2607 (1969) Peats, Mosses, Humus, and RelatedProducts

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-01 Data

Manufacturer's Literature; FIO.

Manufacturer's literature discussing physical characteristics, application and installation instructions for erosion control material, and for chemical treatment material.

SD-07 Schedules

Equipment List; FIO.

A list of proposed pesticide application, seeding and mulching equipment to be used in performance of turfing operation, including descriptive data and calibration tests.

SD-08 Statements

Delivery; FIO.

Delivery schedule, at least 10 days prior to the intended date of the first delivery.

Application of Pesticide; FIO.

Pesticide treatment plan with proposed sequence of pesticide treatment work. The pesticide trade name, chemical composition, formulation, concentration, application rate of active ingredients and method of application for all

materials; and the name and state license number of the state certified applicator shall be included.

Maintenance Report; FIO.

Written record of maintenance work performed.

Turf Establishment Period; FIO.

Written calendar time period for the turf establishment period. When there is more than one turf establishment period, the boundaries of the turfed area covered for each period shall be described.

SD-13 Certificates

Certificates of compliance certifying that materials meet the requirements specified, prior to the delivery of materials. Certified copies of the reports for the following materials shall be included:

Sod; FIO.

For species, mixture percentage, percent purity, field location.

Fertilizer; FIO.

For chemical analysis, composition percent.

Agricultural Limestone; FIO.

For calcium carbonate equivalent and sieve analysis.

Pesticide Material; FIO.

For EPA registration number and registered uses.

Topsoil; FIO.

For pH, particle size, chemical analysis and mechanical analysis.

## 1.3 SOURCE INSPECTIONS

Sod material will be subject to inspection by the Contracting Officer at the growing site.

## 1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

### 1.4.1 Delivery

#### 1.4.1.1 Protection

Sod shall be protected from drying out and contamination during delivery.

#### 1.4.1.2 Topsoil

A soil test shall be provided for topsoil delivered to the site.

#### 1.4.1.3 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

#### 1.4.1.4 Pesticide

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration number and the manufacturer's registered uses.

1.4.2 Inspection

Seed, sod and/or sprigs shall be inspected upon arrival at the job site by the Contracting Officer for conformity to type and quality in accordance with paragraph MATERIALS. Other materials shall be inspected for meeting specified requirements and unacceptable materials shall be removed from the job site.

1.4.3 Storage

Materials shall be stored in areas designated by the Contracting Officer. Sod shall be lightly sprinkled with water, covered with moist burlap, straw, or other covering and protected from exposure to wind and direct sunlight until planted. Covering for sod shall allow air to circulate and prevent internal heat from building up. Seed, lime and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment materials shall not be stored with other landscape materials.

1.4.4 Handling

1.4.4.1 Materials

Care shall be taken to avoid injury to sod and/or sprigs. Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

1.4.4.2 Time Limitation

a. Sod: Limitation of the time between harvesting and placing of sod shall be 36 hours.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 *Omitted*

2.1.2 Sod

2.1.2.1 Sod Classification

State-approved sod shall be provided as classified by applicable state laws. Each individual sod section shall be of a size to permit rolling and lifting without breaking.

2.1.2.2 Grass Species

Grass species shall be proportioned as follows:

Cynodon dactylon ‘Tifton 419', 100 percent pure

2.1.2.3 Quality

The sod shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 50 mm (2 inches) in any dimension, woody plant roots and other material detrimental to a healthy stand of turf. Sod that has become dry, moldy, or yellow from heating, or has irregularly shaped pieces of sod and torn or uneven ends shall be rejected.

2.1.2.4 Thickness

Sod shall be machine cut to a uniform thickness of 30 mm (1-1/4 inches) within a tolerance of 5 mm (1/4 inch), excluding top growth and thatch. Measurement for thickness shall exclude top growth and thatch.

2.1.3 *Omitted*

2.1.4 Soil Amendments

Soil amendments shall consist of lime, fertilizer, organic soil amendments and soil conditioners meeting the following requirements.

2.1.4.1 Lime

Lime shall be agricultural limestone and shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 90 percent will pass a 10-mesh sieve and at least 50 percent will pass a 60-mesh sieve.

2.1.4.2 Fertilizer

Fertilizer shall be commercial grade, free flowing, uniform in composition and conforming to CID A-A-1909. Granular Fertilizer incorporated into amended soil: As recommended by the soil test. Consists of nitrogen-phosphorus-potassium ratio: 10 percent nitrogen, 20 percent phosphorus, and 30 percent potassium. Granular Fertilizer applied two weeks after sod is installed: As recommended by the soil test. Consists of nitrogen-phosphorus-potassium ratio: 34 percent nitrogen,0 percent phosphorus, and 0 percent potassium.

2.1.4.3 Organic Soil Amendments

Topsoil: The existing surface soil shall be stripped and stockpiled on the site in accordance with Section 02210 GRADING. When required beyond that available from stripping, the topsoil shall be delivered. Delivered topsoil shall conform to topsoil requirements specified in Section 02210 GRADING, and shall be amended as recommended by soil test.

2.1.7 Water

Water shall be provided on site.

2.1.8 Pesticide

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide and miticide. For the purpose of this specification, soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved herbicide.

PART 3 EXECUTION

3.1 SEEDING, SODDING AND SPRIGGING TIMES AND CONDITIONS

3.1.1 *Omitted*
3.1.2 *Omitted*
3.1.3 *Omitted*

3.1.4 Turfing Conditions

Turf operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the turf operations, proposed times shall be submitted to and approved by the Contracting Officer.

## 3.2 SITE PREPARATION

### 3.2.1 Grading

The Contracting Officer shall verify that finished grades are as indicated on drawings, and the placing of topsoil and the smooth grading has been completed in accordance with Section 02210 GRADING.

### 3.2.2 Application of Soil Amendments

#### 3.2.2.1 Soil Test

A soil test shall be performed for pH, chemical analysis and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of turf specified.

#### 3.2.2.2 Lime

Lime shall be applied at the rate recommended by the soil test of 25 kilograms (pounds per 1,000 square feet). Lime shall be incorporated into the soil to a minimum depth of 100 mm (4 inches) or may be incorporated as part of the tillage operation.

#### 3.2.2.3 Fertilizer

Fertilizer shall be applied at the rate recommended by the soil test of 1.5 kilograms (pounds per 1,000 square feet). Fertilizer shall be incorporated into the soil to a minimum depth of 100 mm (4 inches) and may be incorporated as part of the tillage or hydroseeding operation.

### 3.2.3 Tillage

#### 3.2.3.1 Minimum Depth

Soil on slopes gentler than 3-horizontal-to-1-vertical shall be tilled to a minimum depth of 100 mm (4 inches). On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1 vertical, the soil shall be tilled to a minimum depth of 50 mm (2 inches) by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no tillage is required.

### 3.2.4 Finished Grading

#### 3.2.4.1 Preparation

Turf areas shall be filled as needed or have surplus soil removed to attain the finished grade. Drainage patterns shall be maintained as indicated on drawings. Turf areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of erosion or grade deficiencies shall conform to topsoil requirements specified in Section 02210 GRADING. Finished grade shall be 25 mm (1 inch) below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas.

#### 3.2.4.2 Lawn Area Debris

Lawn areas shall have debris and stones larger than 25 mm (1 inch) in any dimension removed from the surface.

#### 3.2.4.3 Field Area Debris

Field areas shall have debris and stones larger than 75 mm (3 inches) in any dimension removed from the surface.

3.2.4.4 Protection

Finished graded areas shall be protected from damage by vehicular or pedestrian traffic and erosion.

3.3 *OMITTED*

3.4 SODDING

3.4.1 General

All disturbed ares of the site shall be sodded. Adequate soil moisture shall be ensured prior to sodding by spraying water on the area to be sodded and wetting the soil to a minimum depth of 25 mm (1 inch).

3.4.2 Placing Sod

Rows of sod shall be placed parallel to and tightly against each other. Joints shall be staggered laterally. The sod strips shall not be stretched or overlapped. All joints shall be butted tight. Voids and air drying of roots shall be prevented. On long slopes, sod shall be laid at right angles to slopes. In ditches, sod shall be laid at right angles to the flow of water. When required, the sod shall be anchored by placing anchors a minimum distance of 600 mm (2 feet) on center with a minimum of two anchors per sod section.

3.4.3 Finishing

Air pockets shall be eliminated and a true and even surface shall be provided by tamping or rolling the sod in place. Displacement of the sod shall be assured by knitting of sod to the soil. Frayed edges shall be trimmed and holes or missing corners shall be patched in the sod.

3.4.4 Watering Sod

Watering shall be started immediately after completing each day of sodding. Water shall be applied at a rate sufficient to ensure moist soil conditions to a minimum depth of 25 mm (1 inch). Run-off and puddling shall be prevented.

3.5 *OMITTED*

3.6 EROSION CONTROL

3.6.1 *Omitted*

3.6.2 Temporary Turf Cover

3.6.2.1 General

When there are contract delays in the turfing operation or a quick cover is required to prevent erosion, the areas designated for turf shall be seeded with a temporary seed as directed by the Contracting Officer.

3.6.2.2 Application

When no other turfing materials have been applied, the quantity of one half of the required soil amendments shall be applied and the area tilled in accordance with paragraph SITE PREPARATION. Seed shall be uniformly broadcast and applied at the rate of 1 kilograms (pounds) per square meter (1,000 square feet). The area shall be watered as required.

3.7 APPLICATION OF PESTICIDE

When pesticide becomes necessary to remove a pest or disease, a state-certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Hydraulic equipment shall be provided for the liquid application of pesticides with a leakproof tank, positive agitation methods, controlled application pressure and metering gauges. A pesticide plan shall be provided to the Contracting Officer as stated in paragraph SUBMITTALS.

3.8 RESTORATION AND CLEAN UP

3.8.1 Restoration

Existing turf areas, pavements and facilities that have been damaged from the turfing operation shall be restored to original condition at Contractor's expense.

3.8.2 Clean Up

Excess and waste material shall be removed from the planting operation and shall be disposed of off the site. Adjacent paved areas shall be cleaned.

3.9 PROTECTION OF TURFED AREAS

Immediately after turfing, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed by the Contracting Officer.

3.10 TURF ESTABLISHMENT PERIOD

3.10.1 Commencement

The Turf Establishment Period for establishing a healthy stand of turf shall begin on the first day of work under this contract and shall end 3 months after the last day of turfing operations required by this contract. Written calendar time period shall be furnished to the Contracting Officer for the Turf Establishment Period. When there is more than one turf establishment period, describe the boundaries of the turfed area covered for each period.

3.10.2 Satisfactory Stand of Turf

3.10.2.1 *Omitted*

3.10.2.2 Sodded Area

A satisfactory stand of turf from the sodding operation is defined as living sod uniform in color and leaf texture. Bare spots shall be no larger than 50 mm (2 inches) square.

3.10.3 Maintenance During Establishment Period

3.10.3.1 General

Maintenance of the turfed areas shall include eradicating weeds, eradicating insects and diseases, protecting embankments and ditches from erosion, maintaining erosion control materials and mulch, protecting turfed areas from traffic, mowing, watering, and post-fertilization.

3.10.3.2 Mowing

a. Lawn Areas: Lawn areas shall be mowed to a minimum height of 38milimeters (1-1/2 inches) when the average height of the turf becomes 50 millimeters (2 inches). Clippings

shall be removed when the amount of cut turf is heavy enough to damage the turfed areas.

3.10.3.3 Watering

Watering shall be at intervals to obtain a moist soil condition to a minimum depth of 25 mm (1 inch). Frequency of watering and quantity of water shall be adjusted in accordance with the growth of the turf. Run-off, puddling and wilting shall be prevented.

3.10.3.4 Post-Fertilization

Nitrogen carrier fertilizer shall be applied at the rate of 1.8 kilograms per hectare (pounds per 1,000 square feet) after the first month and again after the second month prior to the final acceptance. The application shall be timed prior to the advent of winter dormancy and shall avoid excessively high nitrogen levels

3.10.3.5 Pesticide

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

3.10.3.6 Repair

The Contractor shall re-establish as specified herein, eroded, damaged or barren areas. Mulch shall also be repaired or replaced as required.

3.10.3.7 Maintenance Report

A written record shall be furnished to the Contracting Officer of the maintenance work performed.

3.11 FINAL ACCEPTANCE

3.11.1 Preliminary Inspection

Prior to the completion of the Turf Establishment Period, a preliminary inspection shall be held by the Contracting Officer. Time for the inspection shall be established in writing. The acceptability of the turf in accordance with the Turf Establishment Period shall be determined. An unacceptable stand of turf shall be repaired as soon as turfing conditions permit.

3.11.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing.

-- End of Section --

SECTION 02950

TREES, SHRUBS, GROUND COVERS, AND VINES

PART 1 GENERAL

The landscape work includes furnishing labor, materials, equipment, testing, and services, required to prepare all specified planting areas, and to install and maintain specified plant materials. The Work includes but is not limited to the following.

a. All planting required for this Project as described on the Drawings and associated Contract Documents.

b. Soil testing planting areas and imported topsoil, bed preparation and related finish grading as specified herein.

c. Installing, erecting, and maintaining measures to protect landscape work from pedestrian and vehicular damage .

d. Replacement of dead or dying plant material throughout the life of the Contract.

f. Daily clean-up of trash, dirt, and debris in landscaped areas throughout the life of the Contract.

g. Straightening and plumbing trees and plant materials Until the end of the 12 month warranty period..

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF NURSERYMEN (AAN)

AAN-01 (1990) American Standard for Nursery Stock

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2607 (1969) Peats, Mosses, Humus, and Related Products

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-07 Schedules

Application of Pesticide Material; FIO.

A list of the proposed pesticide application equipment to be used in performance of the planting work, including descriptive data and calibration tests.

SD-08 Statements

Delivery; FIO. Application of Pesticide Material; FIO.

The following work plans, before work is started.

a. Delivery Schedule at least 10 days prior to the intended date of the first delivery.

b. Pesticide Treatment Plan, giving proposed sequence of pesticide treatment work, before work is started. The pesticide trade name, chemical composition, formulation, concentration, application rate of active ingredients and methods of application for all materials furnished, and the name and state license number of the state certified applicator shall be included.

SD-09 Reports

Soil Test; GA. Percolation Test; GA.

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-13 Certificates

Topsoil; GA. Soil Amendments; FIO. Plants; FIO. Pesticide; FIO.

Certificates of compliance certifying that materials meet the requirements specified, prior to the delivery of materials. Reports for the following materials shall be included:

a. Topsoil: For pH, chemical analysis, mechanical analysis and particle size.

b. Fertilizer: For chemical analysis and composition percent.

c. Agricultural Limestone: For sieve analysis and calcium carbonate equivalent.

d. Peat: For compliance with ASTM D 2607.

e. Plant Materials: For botanical and common name, size, quantity by species, grade, nursery grown.

f. Pesticide Material: For EPA registration number and registered uses.

SD-18 Records

Plant Establishment Period; GA. Maintenance Report; GA. Maintenance Instructions; GA.

a. Maintenance Report. Written record of maintenance work performed and quantity of plant losses and replacements.

b. Plant Establishment Period. Written calendar time period for the beginning of the plant establishment period. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.

c. Maintenance Instruction. Written instructions for year-round care of installed plants.

1.3 SOURCE INSPECTIONS

1.3.1 Plant Materials

Plant materials shall be subject to inspection at the growing site by the Contracting Officer.

1.3.2 Delivered Topsoil

The source of topsoil shall be subject to inspection by the Contracting Officer.

1.4 SHIPMENT, DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Shipment

Plant materials shall be shipped to the site in covered truck or trailer and shall be protected from damage from freezing, heat, wind and weather.

1.4.1.1 Preparation

Digging and preparation for shipment shall be done in a manner that will not cause shock or damage to branches, trunk, or root systems.

a. Balled and Burlapped (BB) Plants: Ball size and ratio shall be provided as recommended by AAN-01. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be accomplished by hand digging or mechanical devices. Center the plant stem or trunk in the ball and clean cut all roots at the ball surface. No roots shall be pulled from the ground. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with twine.

b. Balled and Potted (Pot) Plants: Ball size and ratio shall be provided as recommended by AAN-01. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be accomplished by hand digging or mechanical devices. The plant stem or trunk shall be centered in the ball and all roots shall be clean cut at the ball surface. No roots shall be pulled from the ground. Containers shall be used to retain the ball unbroken. Container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

c. Balled and Platform (BP) Plants: Ball size and ratio shall be provided as recommended by AAN-01. Plants shall be prepared as BB plants and securely fastened to wood platform for shipping.

d. *Omitted*

e. Container-Grown (C) Plants: Container size shall be provided as recommended by AAN-01. Plants shall be grown in a container sufficiently long for new fibrous roots to have developed and for root mass to retain its shape and hold together when removed from container. Container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

1.4.1.2 Antidesiccant Application

Plants shall be sprayed with an antidesiccant as leaf budding occurs or when plant material has soft growth.

1.4.2 Delivery

1.4.2.1 Identification

Plants shall be identified with durable waterproof labels and weather-resistant ink. Plants shall have attached labels stating the correct plant name and size.

1.4.2.2 Protection During Delivery

Plants shall be protected during delivery to prevent desiccation of the plant or damage to the roots or balls. Branches of plants shall be protected by tying-in the branches and covering all exposed branches.

1.4.2.3 Topsoil

A soil test shall be provided for topsoil delivered to the site.

1.4.2.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

1.4.2.5 Pesticide

Pesticide materials shall be delivered to the site in the original unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration numbers and the registered uses.

1.4.3 Inspection

Plant material shall be inspected upon arrival at the jobsite by the Contracting Officer for conformity to the paragraph PLANTS and paragraph Shipment, and any unacceptable plant material shall be removed from the jobsite.

1.4.4 Storage

1.4.4.1 Plant Storage

Plants not installed on the day of arrival at the site shall be stored and protected in areas designated by the Contracting Officer. Plants shall be protected from exposure to wind and shall be shaded from the sun. Covering that will allow air to circulate and prevent internal heat from building up shall be provided. All plants shall be kept in a moist condition by watering with a fine mist spray until planted.

1.4.4.2 Storage of Other Materials

Soil amendments shall be stored in dry locations away from contaminants. Pesticide materials shall not be stored with other landscape materials. Storage of materials shall be in areas designated or as approved by the Contracting Officer.

1.4.5 Handling

Care shall be taken to avoid injury to plants. Materials shall not be dropped from vehicles. Balled and burlapped plants shall be handled carefully to avoid cracking or breaking the earth ball and container-grown plants shall be handled by the container. Plants shall not be handled by the trunk or stems.

1.4.5.1 Time Limitation

a. Mulch: Limitation of time between installing plant and placing mulch is 48 hours.

1.5 WARRANTY

Furnished plants shall be guaranteed to be in a vigorous growing condition for a period of 12 months regardless of the contract time period. A plant shall be replaced one time under this guarantee. Transplanted existing plants require no guarantee. A written calendar time period for the guarantee of plant growth shall be furnished to the Contracting Officer.

PART 2 PRODUCTS

2.1 PLANTS

2.1.1 Varieties

Plants shall be nursery grown or plantation grown stock conforming to AAN-01 and shall be of the varieties specified in the plant list bearing botanical names listed in one or more of the publications listed under "Nomenclature" in AAN-01.

2.1.2 Substitutions

Substitutions will not be permitted without written request from the Contractor for approval by the Contracting Officer.

2.1.3 Growing Conditions

Plants shall be grown under climatic conditions similar to those in the locality of the project.

2.1.4 Quality

Well shaped, well grown, vigorous, healthy plants having healthy and well branched root systems shall be provided. Plants shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plants shall be provided that are typical of the species or variety and conforming to standards as set forth in AAN-01 and as specified herein and on the Plant Schedule.

2.1.4.1 Shade and Flowering Trees

A height relationship to caliper shall be provided as recommended by AAN-01. Height of branching should bear a relationship to the size and variety of tree specified and with the crown in good balance with the trunk. Trees shall not be "poled" or the leader removed.

a. Single stem: Trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there should be no division of the trunk which branches more than 150 mm (6 inches) from ground level.

c. Specimen: A plant shall be provided that is well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

2.1.4.2 Deciduous Shrub

Plants shall be provided that have the height and number of primary stems as recommended by AAN-01. An acceptable plant shall be well shaped with

sufficient well-spaced side branches recognized by the trade as typical for the variety grown in the region.

2.1.4.3 Coniferous Evergreen

Trees shall be provided that have the height-to-spread ratio as recommended by AAN-01. Trees shall not be "poled" or the leader removed. An acceptable plant shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

2.1.4.4 Broadleaf Evergreen

Plants shall be provided that have ratio of height-to-spread as recommended by AAN-01. An acceptable plant shall be well shaped and recognized by the trade as typical for the variety grown in the region.

2.1.4.5 Groundcovers and Vines

Plants shall be provided with the minimum number of runners and length of runner as recommended by AAN-01. Plants shall be furnished that have heavy, well developed and balanced top with vigorous well developed root system and shall be furnished in containers.

2.1.5 Size

Plants shall be furnished in sizes indicated. Plants larger in size than specified may be provided at no additional cost to the Government.

2.1.6 Measurement

Plant measurements shall be in accordance with AAN-01.

2.2 TOPSOIL

Topsoil shall be the existing surface soil stripped to the depth indicated and stockpiled on the site in accordance with Section 02210 GRADING. Additional topsoil, if required, beyond that available from stripping operations, shall be delivered. Delivered topsoil shall conform to topsoil requirement specified in Section 02210 GRADING and shall be amended as recommended by soil tests for the plants specified.

2.2.1 Soil Test

A soil test shall be performed for pH, particle size, chemical analysis and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of plants specified.

2.3 SOIL AMENDMENTS

Soil amendments shall be as specified on Plans.

2.3.1 Lime

Lime shall be agricultural limestone and shall have a minimum calcium carbonate equivalent of 90 percent and shall be ground to such a fineness that at least 90 percent will pass a 10-mesh sieve and at least 50 percent will pass a 60-mesh sieve.

2.3.2 Fertilizer

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

2.3.2.1 Dry Fertilizer

a. Granular fertilizer : Consists of nitrogen-phosphorous-potassium ratio: 10 percent nitrogen, 20 percent phosphorous, and 10 percent potassium.

b. Controlled-Release Fertilizer: Consists of nitrogen-phosphorous-potassium ratio: 10 percent nitrogen, 20 percent phosphorous, and 10 percent potassium. Controlled-release fertilizer may be in packet or tablet form.

2.3.2.2 Liquid Fertilizer

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

2.3.3 *Omitted*

2.3.4 Organic Soil Amendments

2.3.4.1 Peat

Peat shall be a natural product of peat humus derived from a bog, swampland or marsh and shall conform to ASTM D 2607.

2.3.4.2 O*mitted*
2.3.4.3 O*mitted*

2.3.4.4 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, or other wood waste material free of stones, sticks, and toxic substances harmful to plants and stabilized with nitrogen and having the following properties:

| Particle size | Minimum percent by weight passing |
|---|---|
| No. 4 mesh screen | 95 |
| No. 8 mesh screen | 80 |

| Nitrogen Content | Minimum percent based on dry weight |
|---|---|
| Redwood Sawdust | 0.5 |
| Fir Sawdust | 0.7 |
| Fir or Pine Bark | 1.0 |

2.3.5 Soil Conditioner

For single use or in combination to meet requirements for topsoil.

2.3.5.1 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum of 95 percent calcium sulfate by volume.

2.3.5.2 Aluminum Sulfate

Aluminum sulfate shall be commercial grade.

2.4 MULCH

Mulch shall be free from weeds, mold and other deleterious materials.

2.4.1 *Omitted*

2.4.2 Organic Mulch Material

Organic mulch materials shall be clean, fresh, longleaf pine needle ranging in size from .15m (6 inches) to .20m (8 inches).

2.5 *OMITTED*

2.6 TRUNK WRAPPING MATERIAL

Tree wrap shall be two thicknesses of crinkled paper cemented together with a layer of bituminous material. Wrapping material shall be a minimum of 100 mm (4 inches) in width and have a stretch factor of 33-1/3 percent. Twine for tying shall be lightly tarred medium or coarse sisal yarn.

2.7 GUYING AND STAKING MATERIAL

2.7.1 Stakes

Stakes for tree support shall be rough sawn wood, free from knots, rot, cross grain, or other defects that would impair the strength. Standard stakes shall be pine treated with pentachlorophenol.

2.7.1.1 Bracing Stakes

Bracing stakes shall be a minimum of 60 mm (2-1/2 inches) in diameter by 2,400 mm (8 feet) long and pointed at one end.

2.7.1.2 Ground Stakes

Ground stakes shall be a minimum of 50 mm (2 inches) by 50 mm (2 inches) or 60 mm (2-1/2 inches) in diameter by 900 mm (3 feet) long and pointed at one end.

2.7.2 Guying Material

2.7.2.1 Guying Wire

Guying wire shall be 12-gauge annealed galvanized steel wire.

2.7.2.2 Guying Cable

Guying cable shall be a minimum of five-strand, 4.76 mm (3/16-inch) diameter cadmium plated steel cable.

2.7.3 Chafing Guard

Hose chafing guards shall be new or used two-ply reinforced rubber or plastic hose and shall be all the same color on the project. Length shall be 1-1/2 times the circumference of the plant at its base.

2.7.4 Flags

Flags to be fastened to guys shall be white surveyor's plastic tape, 150 mm (6 inches) in length.

2.7.5 Staking

All staking material will be removed after 90 days.

2.8 *OMITTED*

2.9 WATER

Water shall be provided on site.

2.10 ANTIDESICCANT

Antidesiccant shall be an emulsion that will provide a film over plant surfaces permeable enough to permit transpiration, and shall not damage the plant.

2.11 *OMITTED*
2.12 *OMITTED*

2.13 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide, and miticide. Pesticide material shall be labeled for use and applied only as
*2 registered by EPA and approved ~~[herbicide] [insecticide] [fungicide] [nematocide] [rodenticide] [miticide]~~ herbicide, insecticide, fungicide, nematocide, rodenticide, miticide.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Verify Grades

The Contracting Officer shall verify the finished grades are as indicated on drawings, and the placing of topsoil and smooth grading has been completed in accordance with Section 02210 GRADING.

3.1.2 Underground Obstructions to Planting

The location of underground utilities and facilities shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

3.2 SITE PREPARATION

3.2.1 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted by the Contracting Officer to meet field conditions.

3.2.2 Protection of Existing Vegetation

If lawns have been established prior to planting operations, the surrounding turf shall be covered before excavations are made in a manner that will protect turf areas. Existing trees, shrubbery, and beds that are to be preserved shall be barricaded in a manner that will effectively protect them during planting operations.

3.2.2.1 Tree Barriers

*3 Prior to the beginning of demolition, barriers are to be installed 1 foot outside the dripline or critical radius, whichever is greater, of the tree. The dripline is defined as a vertical line extending from the outermost portion of a tree canopy to the ground. The critical radius is the distance from the tree trunk equal to 1.5 feet per inch of tree diameter at 4.5 feet aboveground (D.B.H., diameter at breast height). A detail of the barrier is shown on Sheet ~~L-4~~ L-3.

3.2.2.2 Prior to the beginning of demolition, trees to be preserved will be sprayed with insecticide to help prevent borers. Repeat in 4 weeks. These trees will also be fertilized prior to construction.

3.2.2.3 Do not allow cement or other wastes to be deposited under or drain to the trees. Do not allow the burning of wastes under trees. Do not drive or park vehicles near trees.

3.2.2.4 Trenching

As much as possible, all utilities shall be routed around the dripline or critical radius of the tree. When a utility line must pass inside the critical radius, it shall be bored under the roots at a minimum depth of 24 inches.

3.2.2.5 Raising and Lowering Grades

Contractor shall conduct the Work of this Section so as not to disturb the grades and drainage patterns established by the Grading Contractor. All landscaped areas shall be fine graded to eliminate pockets and low spots, and humps which might impede the flow of stormwater to designated structures or collection points. At no time shall plant beds and grassed areas be graded to direct water towards any building or structures.

3.3 EXCAVATION

3.3.1 Obstructions Below Ground or Poor Drainage

When obstructions below ground or poor drainage affect the contract operation, proposed adjustments to plant location, type of plant and planting method or drainage correction shall be submitted to and approved by the Contracting Officer.

3.3.2 Turf Removal

Where planting beds occur in existing turf areas, the turf shall be removed to a depth that will ensure the removal of the entire root system.

3.3.3 Plant Pits

Plant pits shall be dug to produce vertical sides and flat, uncompacted bottoms. When pits are dug with an auger and the sides of the pits become glazed, the glazed surface shall be scarified. ~~[The size of plant pits shall be as shown.]~~ The size of plant pits shall be as shown. *2

3.3.4 *Omitted*

3.4 PERCOLATION TEST

Test for percolation shall be done to determine positive drainage of plant pits and beds. The Contracting Officer shall be notified in writing of all soil and drainage conditions detrimental to growth of plant material and shall submit proposal for correcting the condition.

3.5 PLANTING TIMES AND CONDITIONS

3.5.1 Deciduous Planting Time

Install deciduous plants from October 1 to April 31.

3.5.2 Evergreen Planting Time

Install evergreen plants from October 1 to April 31.

3.5.3 *Omitted*

3.5.4 Planting Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted to and approved by the Contracting Officer.

3.6 INSTALLATION

3.6.1 *Omitted*

3.6.2 Backfill Soil Mixture

The backfill soil mixture for all ground cover beds shall be a proportioned mixture thoroughly mixed by volume of topsoil and selected soil amendments as described on Plans.

3.6.3 Setting Plants

Plants shall be set plumb and held in position until sufficient soil has been firmly placed around roots or ball. Plants shall be set in relation to surrounding grade so that they are even with the depth at which they were grown in the nursery, or container.

3.6.4 Controlled-Release Fertilizer

Controlled-release fertilizer shall be placed in packet or tablet form in the plant pit in the immediate vicinity of the feeding roots in accordance with the manufacturer's recommendations.

3.6.5 Balled and Burlapped Plants

Materials shall be removed that are metal, plastic, nylon or treated burlap, prior to backfilling. Balled and burlapped stock shall be backfilled with topsoil to approximately half the depth of the ball and then tamped and watered. Biodegradable burlap and tying material shall be carefully opened and folded back. The backfill shall be completed, tamped and watered. A 100 mm (4-inch) high earth saucer shall be formed around individual plants.

3.6.6 Omitted

3.6.7 Container-Grown, Balled and Platformed and Balled and Potted Plants

Nonbiodegradable containers or platforms shall be removed without damage to the plant or root system. Biodegradable containers shall be split. The backfill shall be completed as specified for BB plants.

3.6.8 Groundcover Bed

3.6.8.1 Plant Beds in Existing Soil

Bed shall be tilled to a minimum depth of 150 mm (6 inches) where existing soil is to be used in-place. Selected soil amendments shall be spread uniformly over the bed. Selected soil amendments shall be a proportioned mixture as follows:

Peat 1 parts to 3 parts topsoil.

The mixture shall be thoroughly incorporated into the soil to a minimum depth of 150 mm (6 inches) using a roto-tiller or other method to obtain a uniform and well pulverized soil mix. All sticks, stones, roots and other objectionable materials shall be removed from the surface. The bed shall be brought to a smooth and even surface blending to existing areas.

3.6.8.2 *Omitted*

3.6.8.3 Groundcover

Groundcover may be planted after the mulch is in place. Contaminating the mulch with soil shall be avoided.

3.6.9 *Omitted*

3.6.10 Staking and Guying

3.6.10.1 One Bracing Stake

Trees 1.2 to 1.8 m (4 to 6 feet) tall shall be held in place with one bracing stake. The tree shall be held firmly to the stake with rubber tie (not wire) nailed to the stake. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or roots.

3.6.10.2 Two Bracing Stakes

Trees over 1.8 m (6 feet) tall shall be held in place with two bracing stakes placed on opposite sides. The tree shall be held firmly between the stakes with a double strand of wire. Chafing guards shall be used where the wire contacts the tree. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or roots.

3.6.10.3 Three Guying Wires

Trees shall be held firmly in place with three guying lines of cable spaced equidistantly around the tree. The line shall be anchored with ground stakes. The line shall be anchored to the tree at a point equal to one half its height. Chafing guards shall be used where the line contacts the tree. One turnbuckle shall be centered on each line for tree straightening purposes. Ground stakes shall be driven into firm ground outside the earth saucer and plant pit with the top of the stake flush with the ground surface.

3.6.11 Flags

A flag shall be securely fastened to each guying line to be visible by pedestrians.

3.7 FINISHING

3.7.1 Plant Beds

Planted areas shall be uniformly edged to provide a clear-cut division line between the planted area and the adjacent turf area and to provide a shape as indicated. The entire planted area shall be raked and smoothed while maintaining the earth saucers.

3.7.2 Pruning

The total amount of foliage shall be pruned by one-fourth to one-third on installed trees and shrubs to compensate for loss of roots and transplanting shock. The typical growth habit of individual plants shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to

the line of growth shall not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off." Cuts or wounds measuring a minimum 15 mm (1/2 inch) in diameter shall be painted with the specified tree wound dressing.

3.7.3 Mulch

Mulch shall be spread to a uniform thickness of 100 mm (4 inches) within 48 hours after planting. Mulch shall be kept out of the crowns of shrubs and off buildings, sidewalks and other facilities.

3.7.4 *Omitted*

3.7.5 Trunk Wrap

The trunks to deciduous trees shall be wrapped within 24 hours after planting. Trees 40 mm (1-1/2 inches) or greater in caliper shall be wrapped with the specified material beginning at the base and extending up to the first branches. The wrapping shall be securely tied with twine at the top and bottom and at 500 mm (18-inch) intervals.

3.7.6 Water

Plants shall be watered as necessary to maintain an adequate supply of moisture within the root zone. Run-off, puddling and wilting shall be prevented. For trees follow the watering guide for 3-1/2 months; then gradually taper off the number of waterings per week.

DAILY TREE WATERING GUIDE
(For Sandy and Loom Soils)*

| Tree Caliper | Water Amount |
|---|---|
| 1" | 5 gallons |
| 2" | 10 gallons |
| 3" | 15 gallons |
| 4" | 20 gallons |
| 5" | 30 gallons |

*For clay soil water every other day. Check the waterholding capacity of the soil. Do not overwater.

3.7.7 Antidesiccant Application

Plants requiring further protection shall be sprayed with anti-desiccant in accordance with manufacturer's recommendations.

3.8 MAINTENANCE DURING PLANTING OPERATION

Installed plants shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed and shall continue until the plant establishment period commences. The maintenance includes watering, pruning, wound dressing, straightening and other necessary operations. Plant beds and earth saucers shall be kept free of weeds, grass and other undesired vegetation. Plants shall be checked for settlement and shall be reset proper grade as necessary. Run-off, puddling and wilting shall be prevented.

3.9 CARE OF EXISTING PLANT MATERIAL

3.9.1 Identification

Existing plant material to be treated shall be tagged on the site and/or as

indicated.

3.9.2 Fertilizing Existing Trees

Holes shall be dug by hand or mechanical devices, a minimum 40 mm (1-1/2 inches) in diameter and 500 mm (18 inches) deep, distributed evenly at not more than 600 mm (2 feet) on center throughout the outer half of the branch spread zone of each tree.

3.9.2.1 Dry Fertilizer

Dry fertilizer shall be placed in the hole to within 100 mm (4 inches) of the surrounding grade.

3.9.2.2 Application

Packet, tablet or wedge-form fertilizer shall be applied in accordance with manufacturer's recommendations.

3.9.2.3 Backfill

Topsoil or sand shall be used as backfill in the hole and shall be blended to the surrounding grade.

3.9.3 Fertilizing Existing Shrubs

Existing shrubs shall be top dressed with dry fertilizer at the rate of 1.5 kilograms per square meter (pounds per 100 square feet) of area. Fertilizer adhering to plants shall be flushed with water.

3.9.4 Pruning and Cavity Work

An arborist shall perform the required pruning and cavity work on existing plants. Dead wood larger than 15 mm (1/2 inch) in diameter, branches interfering with or hindering the healthy growth of plants, and diseased branches shall be removed. Cut back or remove branches as necessary to give the plants proper shape and balance. Stubs, improper cuts, and broken limbs shall be removed. Clean cuts shall be made flush with the parent trunk. Wounds larger than 15 mm (1/2 inch) in diameter and scars from contractor operations shall be cleaned. Cavities shall be shaped to provide drainage and decayed wood shall be removed. Exposed cambium layers shall be sealed with shellac. Cuts, wounds and cavity work shall be painted with tree wound dressing.

3.10 APPLICATION OF PESTICIDE MATERIAL

When pesticide becomes necessary to remove a disease or pest, a State-certified applicator shall apply required pesticide in accordance with State EPA label restrictions and recommendations. Hydraulic equipment shall be provided for the liquid application of pesticides with a leakproof tank, positive agitation methods, controlled application pressure and metering gauges. A pesticide treatment plan shall be provided to the Contracting Officer as specified in paragraph SUBMITTALS.

3.11 RESTORATION AND CLEAN UP

3.11.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

3.11.2 Clean Up

Excess and waste material from the planting operation shall be removed and disposed of off the site. Adjacent paved areas shall be cleared.

## 3.12 PLANT ESTABLISHMENT PERIOD

### 3.12.1 Commencement

On completion of the last day of the planting operation, the plant establishment period for maintaining installed plants in a healthy growing condition shall commence and shall be in effect for the remaining contract time period not to exceed 12 months. When the planting operation extends over more than one season or there is a variance to the planting times, plant establishment periods shall be established for the work completed, as directed. Written calendar time period shall be furnished to the Contracting Officer for the beginning of the plant establishment period. When there is more than one plant establishment period, describe the boundaries of the planted area covered for each period.

### 3.12.2 Maintenance During Establishment Period

#### 3.12.2.1 General

Maintenance of plants shall include straightening plants, tightening stakes and guying material, repairing tree wrapping, protecting plant areas from erosion, maintaining erosion control material, supplementing mulch, accomplishing wound dressing, removing dead or broken tip growth by pruning, maintaining edging of beds, checking for girdling of plants and maintaining plant labels, watering, weeding, removing and replacing unhealthy plants.

#### 3.12.2.2 Water

The plants shall be watered as necessary to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of one inch of absorbed water per week delivered in the form of natural rain or augmented as required by periodic waterings. Run-off, puddling and wilting shall be prevented.

#### 3.12.2.3 Weeding

Grass and weeds in earth saucers and plant beds shall not be allowed to reach a height of 80 mm (3 inches) before being completely removed, including the root growth.

#### 3.12.2.4 Unhealthy Plants

A plant shall be considered unhealthy or dead when the main leader has died back, or 25 percent of the crown is dead. Determine the cause for an unhealthy plant. Unhealthy or dead plants shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

#### 3.12.2.5 Fertilizing

The plants shall be topdressed at least once during the period of establishment with dry fertilizer at the rate of 1 kilogram per square meter (pounds per 100 square feet) of plant pit or bed area or foliar feed plants with liquid fertilizer. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

#### 3.12.2.6 Settlement

Topsoil shall be added to maintain grade and to maintain earth saucers. Serious settlement affecting the setting of the plant in relation to the depth at which it was grown requires replanting in accordance with paragraph INSTALLATION.

3.12.2.7 Pesticide Treatment

Treatment for diseases or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE MATERIAL.

3.12.2.8 Maintenance Report

A written record shall be furnished to the Contracting Officer of the maintenance work performed, the quality of plant losses, cause for plant loss and replacements made on each site visit.

3.12.2.9 Maintenance Instructions

Written instructions shall be furnished to the Contracting Officer for year-round care of installed plants.

3.12.3 Replacement Plants

Plants shall be provided for replacement in accordance with paragraph PLANTS. Replacement plants shall be installed in accordance with paragraph INSTALLATION. No extended plant establishment period Shall be required for replacement plants. A plant will be replaced in accordance with paragraph WARRANTY.

3.13 FINAL ACCEPTANCE

3.13.1 Preliminary Inspection

Prior to the completion of the plant establishment perioda preliminary inspection shall be held by the Contracting Officer. Time for the inspection will be established in writing. The quantity and type of plants installed and the acceptability of the plants in accordance with the plant establishment period shall be determined.

3.13.2 Final Inspection

A final inspection shall be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Time for the inspection shall be established in writing. Acceptance of the planting operation is subject to the guarantee of plant growth.

-- End of Section --

SECTION 03100

STRUCTURAL CONCRETE FORMWORK

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 347R (1988) Guide to Formwork for Concrete

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:

Concrete Formwork; FIO.

Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

Form Releasing Agents; FIO.

Manufacturer's recommendation on method and rate of application of form releasing agents.

1.3 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

PART 2 PRODUCTS

2.1 FORM MATERIALS

2.1.1 Forms For Class B Finish

Forms for Class B finished surfaces shall be plywood panels conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood

concrete form panels.

2.1.2 Forms For Class C Finish

Forms for Class C finished surfaces shall be plywood conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used.

2.1.3 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

2.1.4 Omitted
2.1.5 Omitted

2.1.6 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 6 mm (1/4 inch) nor more than 25 mm (1 inch) deep and not more than 25 mm (1 inch) in diameter. Removable tie rods shall be not more than 38 mm (1-1/2 inches) in diameter.

2.1.7 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

## 3.3 COATING

Forms for Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

## 3.4 REMOVAL OF FORMS

Forms shall be removed in a manner that will prevent injury to the concrete and ensure the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads. In no case will supporting forms or shores be removed before the concrete strength has reached 70 percent of design strengths as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

TABLE 1

TOLERANCES FOR FORMED SURFACES

| | |
|---|---|
| 1. Variations from the plumb: | In any 3 m of length ----- 6 mm |
| a. In the lines and surfaces of columns, piers, walls and in arises | Maximum for entire length ----- 25 mm |
| b. For exposed corner columns, control-joint grooves, and other conspicuous lines | In any 6 m of length ----- 6 mm<br>Maximum for entire length ---- 13 mm |
| 2. Variation from the level or from the grades indicated on the drawings: | In any 3 m of length ----- 6 mm<br>In any bay or in any 6 m of length ---------- 10 mm |
| a. In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores | Maximum for entire length ---- 20 mm |

| | | |
|---|---|---|
| | b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines | In any bay or in any 6 m of length ---------- 6 mm<br>Maximum for entire length ---- 13 mm |
| 3. | Variation of the linear building lines from established position in plan | In any 6 m ---------- 13 mm<br>Maximum ---------- 25 mm |
| 4. | Variation of distance between walls, columns, partitions | 6 mm per 3 m of distance, but not more than 13 mm in any one bay, and not more than 25 mm total variation |
| 5. | Variation in the sizes and locations of sleeves, floor openings, and wall opening | Minus ---------- 6 mm<br>Plus ---------- 13 mm |
| 6. | Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls | Minus ---------- 6 mm<br>Plus ---------- 13 mm |
| 7. | Footings: | |
| | a. Variation of dimensions in plan | Minus ---------- 13 mm<br>Plus ---------- 50 mm<br>when formed or plus 75 mm when placed against unformed excavation |
| | b. Misplacement of eccentricity | 2 percent of the footing width in the direction of misplacement but not more than ---------- 50 mm |
| | c. Reduction in thickness | Minus ---------- 5 percent of specified thickness |
| 8. | Variation in steps: | Riser ---------- 3 mm |
| | a. In a flight of stairs | Tread ---------- 6 mm |
| | b. In consecutive steps | Riser ---------- 2 mm<br>Tread ---------- 3 mm |

-- End of Section --

SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE

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 |

AMERICAN CONCRETE INSTITUTE (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 | 1989) Structural Concrete for Buildings |
| ACI 305R | (1991) Hot Weather Concreting |
| ACI 318/318R | (1989; Rev 1992; Errata) Building Code Requirements for Reinforced Concrete |

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 | (1993a) Compressive Strength of Cylindrical Concrete Specimens |
| ASTM C 42 | (1990) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete |
| ASTM C 94 | (1994) 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 | (1993) Sieve Analysis of Fine and Coarse Aggregates |
| ASTM C 143 | (1990a) Slump of Hydraulic Cement Concrete |
| ASTM C 150 | (1994) Portland Cement |
| 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 | (1994) Air-Entraining Admixtures for Concrete |
| ASTM C 309 | (1993) Liquid Membrane-Forming Compounds for Curing Concrete |
| ASTM C 494 | (1992) Chemical Admixtures for Concrete |
| ASTM C 578 | (1992) Rigid, Cellular Polystyrene Thermal Insulation |
| ASTM C 591 | (1985) Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation |
| ASTM C 595 | (1994a) Blended Hydraulic Cements |
| ASTM C 618 | (1994) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete |
| ASTM C 685 | (1994) Concrete Made by Volumetric Batching and Continuous Mixing |
| ASTM C 881 | (1990) Epoxy-Resin-Base Bonding Systems for Concrete |
| ASTM C 940 | (1989) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory |
| ASTM C 989 | (1993) 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 1064 | (1986, R 1993) Temperature of Freshly Mixed Portland Cement Concrete |
| ASTM C 1077 | (1995) Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation |

| | |
|---|---|
| ASTM C 1116 | (1991) Fiber-Reinforced Concrete and Shotcrete |
| 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 E 96 | (1994) Water Vapor Transmission of Materials |

CORPS OF ENGINEERS (COE)

| | |
|---|---|
| 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 |

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

| | |
|---|---|
| NIST HB 44 | (1994) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices |

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

| | |
|---|---|
| NRMCA-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 OMITTED
1.3 OMITTED

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-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.

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.

## 1.5 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.

## 1.6 FIELD TEST PANELS

Field test panels 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 shall be subject to the approval of the Contracting Officer, and, if not judged satisfactory, additional panels 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.

### 1.6.1 Sample Wall Panels

One sample panel at least 1220 mm (4 feet) by 1525 mm (5 feet) and 150 mm (6 inches) thick shall be constructed to demonstrate Class A formed finish and a similar one for Class B formed finish. Panels shall be located on the project site where directed. Each panel shall include a full length and full width joint line and shall have at least two voids each at least 300 mm (12 inches) by 300 mm (12 inches) by 75 mm (3 inches) deep either impressed in the concrete as placed or chipped in the hardened concrete. After the concrete is 7 days old, the voids shall be patched to demonstrate the effectiveness and the appearance of the Contractor's repair procedures.

## 1.7 OMITTED

1.8 GENERAL REQUIREMENTS

1.8.1 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.

1.8.1.1 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 |

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

1.8.1.2 Omitted

1.8.1.3 Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117/A117R, using a 3 m (10-foot) straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straightedge can be placed.

Trowel Finish 5 mm

1.8.2 Strength Requirements and w/c Ratio

1.8.2.1 Strength Requirements

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

| COMPRESSIVE STRENGTH | STRUCTURE OR PORTION OF STRUCTURE |
|---|---|
| 27.5 MPa (4,000 psi) at 28 days | Slab on Grade and Vaults |
| 20 MP a (3,000 psi) at 28 days | Foundations |

Compressive strength shall be determined in accordance with ASTM C 39.

a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (152 by 305 mm (6- by 12-inch) cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength f'c and no individual test result falls below the specified strength f'c by more than 3.5 MPa (500 psi). A "test" is defined as the average of two companion cylinders,

or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

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

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

1.8.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as follows:

| WATER-CEMENT RATIO, BY WEIGHT | STRUCTURE OR PORTION OF STRUCTURE |
|---|---|
| 0.50 | Slab on Grade and Vaults |
| 0.55 | Foundations |

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

1.8.3 Air Entrainment

All normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 19 mm (3/4 inch) or smaller it shall be between 4.5 and 7.5 percent. 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.

1.8.4 Slump

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

| Structural Element | Slump Minimum | Slump Maximum |
|---|---|---|
| Walls, columns and beams | 50 mm (2 in.) | 100 mm (4 in.) |
| Foundation walls, substructure walls, footings, slabs | 25 mm (1 in.) | 75 mm (3 in.) |
| Any structural concrete approved for placement by pumping: | | |
| At pump | 50 mm (2 in.) | 150 mm (6 in.) |
| At discharge of line | 25 mm (1 in.) | 100 mm (4 in.) |

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 (2 to 4 inches) before the admixture is added and a maximum slump of 200 mm (8 inches) at the point of delivery after the admixture is added.

1.8.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 32 degrees C (90 degrees F). When the ambient temperature during placing is 5 degrees C (40 degrees F) or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 12 and 25 degrees C (55 and 75 degrees F).

1.8.6 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.

1.8.7 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.

1.9 MIXTURE PROPORTIONS

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

1.9.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on compressive strength as

determined by test specimens fabricated in accordance with ASTM C 192 and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in the paragraph Maximum Allowable w/c Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations in ACI 211.1 for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by weight of the total cementitious material, and the maximum shall be 35 percent. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until 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.

1.9.2 Omitted
1.9.3 Omitted

1.9.4 Average Compressive Strength Required for Mixtures

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

1.9.4.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength

or strengths (f'c) within 7 Mpa (1,000 psi) of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength f'cr used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

f'cr = f'c + 1.34S

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 |

1.9.4.2 Computations without Previous Test Records

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

a. If the specified compressive strength f'c is less than 20 MPa, (3,000 psi,)

f'cr = f'c + 6.9 MPa (f'cr = f'c + 1,000 psi)

b. If the specified compressive strength f'c is 20 to 35 MPa, (3,000 to 5,000 psi,)

f'cr = f'c + 8.3 MPa (f'cr = f'c + 1,200 psi)

1.10 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.

1.11 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.

1.11.1 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.

1.11.2 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.

1.11.3 Hardened Concrete

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

1.11.4 Inspection

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

PART 2 PRODUCTS

2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be portland cement, portland-pozzolan cement, portland blast-furnace slag cement, or portland cement in combination with pozzolan [or ground granulated blast furnace slag 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.

2.1.2 Omitted

2.1.3 Blended Cements

ASTM C 595, Type IP IS.

2.1.4 Pozzolan (Fly Ash)

ASTM C 618, Class C with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. Requirement for

maximum alkalies from Table 1A of ASTM C 618 shall apply. If pozzolan is used, it shall never be less than 15 percent nor more than 35 percent by weight of the total cementitious material.

2.1.5 Ground Granulated Blast-Furnace (GGBF) Slag

ASTM C 989, Grade 120.

2.2 AGGREGATES

Aggregates shall conform to the following.

2.2.1 Fine Aggregate

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

2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S, size designation No. 67.

2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

2.3.1 Air-Entraining Admixture

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

2.3.2 Accelerating Admixture

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

2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D, except that the 6-month and 1 year compressive and flexural strength tests are waived.

2.3.4 High-Range Water Reducer

ASTM C 494, Type F or G, except that the 6-month and 1 year strength requirements are waived. The admixture shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

2.3.5 Surface Retarder

COE CRD-C 94.

2.3.6 Omitted

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 Omitted

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.

2.9 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.

2.10 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Hangers for suspended ceilings shall be as specified in Section 09510 ACOUSTICAL CEILINGS. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel.

2.11 FLOOR HARDENER

Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These silicofluorides can be used individually or in combination. Proprietary hardeners may be used if approved in writing by the Contracting Officer.

2.12 PERIMETER INSULATION

Perimeter insulation shall be polystyrene conforming to ASTM C 578, Type II; polyurethane conforming to ASTM C 591, Type II; or cellular glass conforming to ASTM C 552, Type I or IV.

2.13 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 0.15 mm (6 mils) or other equivalent material having a vapor permeance rating not exceeding 28.6 nanograms per Pascal per second per square meter (0.5 perms) as determined in accordance with ASTM E 96.

2.14 JOINT MATERIALS

2.14.1 Joint Fillers, Sealers, and Waterstops

Expansion joint fillers shall be preformed materials conforming to ASTM D 1751.

2.15 SYNTHETIC FIBERS FOR REINFORCING

Synthetic fibers shall conform to ASTM C 1116, Type III, Synthetic Fiber, and as follows. Fibers shall be 100 percent virgin polypropylene fibrillated fibers containing no reprocessed olefin materials. Fibers shall have a specific gravity of 0.9, a minimum tensile strength of 480 MPa (70 ksi) graded per manufacturer, and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement.

PART 3 EXECUTION

3.1 PREPARATION FOR PLACING

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

3.1.1 Foundations

3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

3.1.1.2 Omitted

3.1.1.3 Excavated Surfaces in Lieu of Forms

Concrete for footings may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 02221 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances.

3.1.2 Preparation of Previously Placed Concrete

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

### 3.1.3 Vapor Barrier

Vapor barrier shall be provided beneath the interior on-grade concrete floor slabs. The greatest widths and lengths practicable shall be used to eliminate joints wherever possible. Joints shall be lapped a minimum of 300 mm (12 inches). Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete. For minor repairs, patches may be made using laps of at least 300 mm (12 inches). Lapped joints shall be sealed and edges patched with pressure-sensitive adhesive or tape not less than 50 mm (2 inches) wide and compatible with the membrane. Vapor barrier shall be placed directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier. In this case, the surface shall be choked with a light layer of sand, as approved, before placing the vapor barrier. A 50 mm (2-inch) layer of compacted, clean concrete sand (fine aggregate) shall be placed on top of the vapor barrier before placing concrete. Concrete placement shall be controlled so as to prevent damage to the vapor barrier, or any covering sand.

### 3.1.4 Perimeter Insulation

Perimeter insulation shall be installed at locations indicated. Adhesive shall be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

### 3.1.5 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 600 mm (2 feet) of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

## 3.2 CONCRETE PRODUCTION

### 3.2.1 Batching, Mixing, and Transporting Concrete

Concrete shall either be batched and mixed onsite or shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA-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 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
*2 cumulatively, provided that the portland cement is batched first. ~~[except that silica fume shall always be batched separately]~~. 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 or truck mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

3.2.1.7 Stationary Mixers

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

3.2.1.8 Truck Mixers

Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C 94. A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Each truck shall be equipped with two counters from which it is possible to determine the number of revolutions at mixing speed and the number of revolutions at agitating speed. Water shall not be added at the placing site unless specifically approved; and in no case shall it exceed the specified w/c. Any such water shall be injected at the base of the mixer, not at the discharge end.

3.3 OMITTED
3.4 OMITTED

3.5 FIBER REINFORCED CONCRETE

Fiber reinforced concrete shall conform to ASTM C 1116 and as follows, using the fibers specified in PART 2. A minimum of 0.9 kg of fibers per cubic m (1.5 pounds of fibers per cubic yard) of concrete shall be used. Fibers shall be added at the batch plant. The services of a qualified technical representative shall be provided to instruct the concrete supplier in proper batching and mixing of materials to be provided.

3.6 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers or by approved pumping equipment.

## 3.7 CONVEYING CONCRETE ON SITE

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

### 3.7.1 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 (2 square feet). The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 1.5 cubic meters (2 cubic yards) shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

### 3.7.2 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.

### 3.7.3 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94.

### 3.7.4 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.

### 3.7.5 Belt Conveyors

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means, such as discharge baffle or hopper , for preventing segregation of the concrete at the transfer points and the point of placing. Belt conveyors shall be constructed such that the idler spacing shall not exceed 900 mm (36 inches). The belt speed shall be a minimum of 90 meters (300 feet) per minute and a maximum of 225 meters (750 feet) per minute. If concrete is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend through the reinforcing bars.

### 3.7.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing

equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least three times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 100 mm (4 inches). Aluminum pipe shall not be used.

## 3.8 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 (85 degrees F), the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

### 3.8.1 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 (5 feet) except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 300 mm (12 inches) thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

### 3.8.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 100 mm (4 inches) thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.6 mm (0.025 inch), and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 150 mm (6 inches) into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and

unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 100 mm (4 inches) and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

3.8.3 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 (40 degrees F). The temperature of the concrete when placed shall be not less than 10 degrees C (50 degrees F) nor more than 25 degrees C (75 degrees F). Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

3.8.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 30 degrees C (85 degrees F), the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 49 degrees C (120 degrees F). Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

| Relative Humidity, Percent, During Time of Concrete Placement | Maximum Allowable Concrete Temperature Degrees |
|---|---|
| Greater than 60 | 33 C (90 F) |
| 40-60 | 30 C (85 F) |
| Less than 40 | 27 C (80 F) |

3.8.5 Omitted
3.8.6 Omitted

3.8.7 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.

3.8.8 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.

3.9 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in slabs on grade. Reinforcement shall be 50 mm (2 inches) 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 (30-pound) asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section 07920 JOINT SEALING.

3.9.1 Construction Joints

For concrete other than slabs on grade, construction joints shall be located as indicated or approved. Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 25 mm (1 inch) square-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at

the construction joint. Concrete shall be placed to a point 25 mm (1 inch) above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

3.9.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by sawing a continuous slot with a concrete saw. It shall be 1/4 the depth of the slab thickness and between 3 and 5 mm (1/8 and 3/16 inch) wide. For saw-cut joints, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent ravelling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Reservoir for joint sealant shall be formed as previously specified.

3.9.3 Omitted
3.9.4 Omitted

3.9.5 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.

3.10 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03100 STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class A or B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/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.

3.10.1 Class B Finish

Class B finish is required in the Arms Vault and Fins, ravelings, and loose material shall be removed, all surface defects over 12 mm (1/2 inch) in diameter or more than 12 mm (1/2 inch) deep, shall be repaired 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. Defects more than 12 mm (1/2 inch) in diameter shall be cut back to sound concrete, but in all cases at least 25 mm (1 inch) deep. The Contractor shall prepare a sample panel for approval (as specified in PART 1) before commencing repair, showing that the surface texture and color match will be attained.

3.10.2 Class D Finish

Class D finish is required in the piers. 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 (1/2 inch) deep or more than 50 mm (2 inches) in diameter shall be repaired. Defects more than 50 mm (2 inches) in diameter shall be cut back to sound concrete, but in all cases at least 25 mm (1 inch) deep.

3.11 REPAIRS

3.11.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 100 mm (4 inches) shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the 1.18 mm (No. 16 mesh) sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

3.11.2 Repair of Major Defects

Major defects will be considered to be those more than 12 mm (1/2 inch) deep or, for Class A and B finishes, more than 12 mm (1/2 inch) in diameter and, for Class C and D finishes, more than 50 mm (2 inches) in diameter. Also included are any defects of any kind whose depth is over 100 mm (4 inches) or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

3.11.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 50 mm (2 inches) on all sides. All such defective areas greater than 7800 square mm (12 square inches) shall be outlined by saw cuts at least 25 mm (1 inch) deep. Defective areas less than 7800 square mm

(12 square inches) shall be outlined by a 25 mm (1 inch) deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-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.

3.11.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 150 mm (6 inches) deep and also have an average diameter at the surface more than 450 mm (18 inches) or that are otherwise so identified by the Project Office. Concrete with such defects shall be completely removed and replaced.

3.12 FINISHING UNFORMED SURFACES

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

3.12.1 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 (50 degrees F). In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing

operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

3.12.2 Rough Slab Finish

As a first finishing operation for unformed surfaces and as final finish for slabs to receive mortar setting beds, the surface shall receive a rough slab finish prepared as follows shall receive only a rough slab finish. 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.

3.12.3 Omitted

3.12.4 Troweled Finish

All interior slabs, except those that receive a rough slab finish, shall be given a trowel 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. 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.

3.12.5 Omitted

3.12.6 Non-Slip Finish

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

3.12.6.1 Broomed

Exterior slabs and sidewalks shall be given a broomed finish. After floating, the surface shall be lightly steel troweled, and then carefully scored by pulling a 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.

3.13 FLOOR HARDENER

The Storage Wing and Arms Vault 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 (1 pound) of the

silocofluoride shall be dissolved in 4 liters (1 gallon) of water. For subsequent applications, the solution shall be 1.0 kg (2 pounds) of silicofluoride to each 4 liters (gallon) of water. Floor should be mopped with clear water shortly after the preceding application has dried to remove encrusted salts. Proprietary hardeners shall be applied in accordance with the manufacturer's instructions. During application, area should be well ventilated. Precautions shall be taken when applying silicofluorides due to the toxicity of the salts. Any compound that contacts glass or aluminum should be immediately removed with clear water.

## 3.14 EXTERIOR SLAB AND RELATED ITEMS

### 3.14.1 Omitted

### 3.14.2 Sidewalks

Concrete shall be 100 mm (4 inches) minimum thickness. Contraction joints shall be provided at 1.75 m (5 feet) spaces unless otherwise indicated. Contraction joints shall be cut 25 mm (1 inch) deep with a jointing tool after the surface has been finished. Transverse expansion joints 12 mm (1/2 inch) thick shall be provided at changes in direction and where sidewalk abuts curbs, steps, rigid pavement, or other similar structures. Sidewalks shall be given a lightly broomed finish. A transverse slope of 1 mm per 50 mm (1/4 inch per foot) shall be provided, unless otherwise indicated. Variations in cross section shall be limited to 1 mm per 250 mm (1/4 inch in 5 feet).

### 3.14.3 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 (3 inches) deep with a jointing tool after the surface has been finished. Expansion joints (12 mm (1/2 inch) wide) shall be provided at 35 m (100 feet) maximum spacing unless otherwise indicated. Exposed surfaces shall be finished using a stiff bristled brush.

## 3.15 CURING AND PROTECTION

### 3.15.1 General

Concrete shall be cured by an approved method for the period of time given below:

| | |
|---|---|
| All other concrete | 7 days |

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 10 degrees C (50 degrees F) for the first 3 days and at a temperature above 0 degrees C (32 degrees F) for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded.

### 3.15.2 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.

3.15.3 Membrane Forming Curing Compounds

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 (75 psi), at a uniform coverage of not more than 10 cubic meters per L (400 square feet per gallon) for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied 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.

3.15.4 Omitted
3.15.5 Omitted

3.15.6 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 0 degrees C (32 degrees F) the temperature of the concrete shall be maintained above 5 degrees C (40 degrees F) for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 13 degrees C (25 degrees F) as determined by suitable temperature measuring devices furnished by the Government, as required, and installed adjacent to the concrete surface and 50 mm (2 inches) inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed.

## 3.16 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 20 mm (3/4 inch). Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed.

### 3.16.1 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.

## 3.17 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.

### 3.17.1 Grading and Corrective Action

#### 3.17.1.1 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.

#### 3.17.1.2 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 five 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.

3.17.2 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 3 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.

3.17.3 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 3 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.

3.17.4 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 (cubic yard), amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic meter (cubic yard) for each class of concrete batched during each day's plant operation.

3.17.5 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 and ASTM C 173 for lightweight 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 (1/2 inch) 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 (2 inches). 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 strength on each different concrete mixture placed during the day for each 38 cubic meters (50 cubic yards) 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 and ASTM C 78 for test beams. 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 paragraph Strength Requirements in PART 1) moving average of last three "tests" for strength, and moving average for range for the last three "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

3.17.6 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.

3.17.7 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.

3.17.8 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.

3.17.9 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 (square feet per gallon), and shall note whether or not coverage is uniform.

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

3.17.10 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.

3.17.11 Omitted

3.17.12 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.

-- End of Section --

SECTION 04200

MASONRY

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

ACI SP-66 (1994) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82 (1994) Steel Wire, Plain, for Concrete Reinforcement

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

ASTM A 615 (1995) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C 55 (1995) Concrete Building Brick

ASTM C 62 (1995) Building Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C 67 (1994) Sampling and Testing Brick and Structural Clay Tile

ASTM C 90 (1995) Loadbearing Concrete Masonry Units

ASTM C 126 (1994) Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units

ASTM C 129 (1995) Nonloadbearing Concrete Masonry Units

ASTM C 140 (1995a) Sampling and Testing Concrete Masonry Units

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

ASTM C 270 (1995) Mortar for Unit Masonry

ASTM C 476 (1991) Grout for Masonry

ASTM C 494 (1992) Chemical Admixtures for Concrete

ASTM C 578 (1992) Rigid, Cellular Polystyrene Thermal Insulation

ASTM C 641 (1982; R 1991) Staining Materials in Lightweight Concrete Aggregates

ASTM C 652 (1994) Hollow Brick (Hollow Masonry Units Made From Clay or Shale)

ASTM C 744 (1995) Prefaced Concrete and Calcium Silicate Masonry Units

ASTM C 780 (1994) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

ASTM C 1019 (1989a; R 1993) Sampling and Testing Grout

ASTM C 1289 (1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

ASTM D 2000 (1990; R 1994) Rubber Products in Automotive Applications

ASTM D 2240 (1991) Rubber Property - Durometer Hardness

ASTM D 2287 (1992) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds

ASTM E 119 (1995a) Fire Tests of Building Construction and Materials

ASTM E 447 (1992b) Compressive Strength of Masonry Prisms

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

Clay or Shale Brick; FIO. Concrete Brick; FIO. Concrete Masonry Units; FIO. Insulation; FIO. Precast Architectural Concrete, FIO.

Manufacturer's descriptive data.

SD-04 Drawings

Masonry Work; GA.

Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; and wall openings.
*4 Bar splice locations shall be shown. If the Contractor chooses to use inch-pound CMU products, the drawings shall also locate all cut CMU products. Architectural elevations shall be submitted indicating the location of all cut, exposed brick and CMU products. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1 to 50 (1/4 inch per foot). Reinforcement bending details shall conform to the requirements of ACI SP-66. Precast architectural concrete.

SD-08 Statements

Cold Weather Installation; FIO.

Cold weather construction procedures.

SD-09 Reports

Efflorescence Test; FIO. Field Testing of Mortar; FIO. Field Testing of Grout; FIO. Prism Tests; FIO. Fire-rated CMU; FIO.

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

Special Inspection; FIO

Copies of masonry inspector reports.

SD-13 Certificates

Clay or Shale Brick; FIO. Concrete Brick; FIO. Concrete Masonry Units (CMU); FIO. Control Joint Keys; FIO. Anchors, Ties, and Bar Positioners; FIO. Expansion-Joint Materials; FIO. Joint Reinforcement; FIO. Reinforcing Steel Bars and Rods; FIO. Mortar Coloring; FIO. Insulation; FIO. Precast Concrete Items; FIO. Mortar Admixtures; FIO. Grout Admixtures; FIO.

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

Insulation; Ridged Extruded Polystyrene Foam.

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

SD-14 Samples

Concrete Masonry Units (CMU); FIO. Concrete Brick; FIO. Clay or Shale Brick; GA. Precast Concrete Unit, FIO.

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

Anchors, Ties, and Bar Positioners; FIO.

Two of each type used.

Expansion-Joint Material; FIO.

One piece of each type used.

Joint Reinforcement; FIO.

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

Insulation; FIO

One piece of board type insulation, not less than 400 mm (16 inches) by 600 mm (24 inches) in size, containing the label indicating the rated permeance and R-values.

Portable Panel; FIO

One panel of clay or shale brick, 600 mm by 600 mm (2 feet by 2 feet), containing approximately 24 brick facings to establish range of color and texture.

## 1.3 SAMPLE MASONRY PANELS

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

### 1.3.1 Configuration

Panels shall be L-shaped or otherwise configured to represent all of the wall elements. Panels shall be of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. The minimum size of a straight panel or a leg of an L-shaped panel shall be 2.5 m (8 feet long) by 1.8 m (6 feet high).

### 1.3.2 Composition

Panels shall show full color range, texture, and bond pattern of the masonry work. The Contractor's method for mortar joint tooling; grouting of reinforced vertical cores, collar joints, bond beams, and lintels; positioning, securing, and lapping of reinforcing steel; positioning and lapping of joint reinforcement (including prefabricated corners); and cleaning of masonry work shall be demonstrated during the construction of the panels. Installation or application procedures for anchors, wall ties, CMU control joints, brick expansion joints, insulation, flashing, brick soldier, row lock courses and weep holes shall be shown in the sample panels. The panels shall contain a masonry bonded corner that includes a bond beam corner. Panels shall show installation of electrical boxes and conduit. Panels that represent reinforced masonry shall contain a 600 mm by 600 mm (2-foot by 2-foot) opening placed at least 600 mm (2 feet) above the panel base and 600 mm (2 feet) away from all free edges, corners, and control joints. Required reinforcing shall be provided around this opening as well as at wall corners and control joints. Show installation of interior metal wall furring.

### 1.3.3 Construction Method

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

### 1.3.4 Usage

The completed panels shall be used as the standard of workmanship for the type of masonry represented. Masonry work shall not commence until the sample panel for that type of masonry construction has been completed and approved. Panels shall be protected from the weather and construction operations until

the masonry work has been completed and approved. After completion of the work, the sample panels, including all foundation concrete, shall become the property of the Contractor and shall be removed from the construction site.

1.4 DELIVERY, HANDLING, AND STORAGE

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

1.4.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather and shall conform to the moisture content as specified in ASTM C 90 when delivered to the jobsite. Prefabricated lintels, if used, shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.4.2 Reinforcement, Anchors, and Ties

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

1.4.3 Cementitious Materials, Sand and Aggregates

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

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting
*4 Officer's approval. The Contractor has the option to use either hard metric or substitute English inch-pound (soft metric) CMU products. If the Contractor decides to substitute English inch-pound CMU products, the following additional requirements shall be met:

2.1.1 The metric dimensions indicated on the drawings shall not be altered to accommodate English inch-pound CMU products either horizontally or vertically. The 100 mm building module will be maintained, except for the CMU products themselves.

2.1.2 Mortar joint widths shall be maintained as specified.

2.1.3 Indicated reinforcing bar spacing shall not be exceeded. Inch-pound CMU products must accommodate reinforcing bar placement. Rebars will not be cut, bent or eliminated to fit into the inch-pound CMU products module.

2.1.4 Brick and inch-pound CMU products cannot be reduced in size by more than one-third in height and one-half in length. Cut CMU products shall not be located at ends of walls, corners, and other openings.

2.1.5 Cut, exposed brick and CMU products shall be held to a minimum and shall be located where it would have the least impact on the architectural aesthetic goals of the facility.

2.1.6 Other building components, built into the CMU products, such as window frames, door frames, louvers, grilles, fire dampers, etc., that are required to be metric, will remain metric.

*4 *5 2.1.7 Additional metric guidance can be found in Section ~~01415~~ 01030 METRIC MEASUREMENTS.

2.2 CLAY OR SHALE BRICK

*12

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

*12

2.2.1 Solid Clay or Shale Brick

Solid clay or shale shall conform to ASTM C 216, Type FBS. Brick size shall be modular and the nominal size of the brick used shall be 57 mm (2-1/4 inches) thick, 92 mm (3-5/8 inches) wide, and 194 mm (7-5/8 inches) long. Minimum compressive strength of the brick shall be 9.0 MPa (1350 psi).

*12

~~2.2.1.1~~

~~Manufacturer: Belden Brick Co.~~
~~Field Color: Dutch Grey~~
~~Accent Color: Quaker~~

~~Colors or color ranges indicated are for identification purposes only and are not intended to limit selection of similar color or color range from other manufacturers.~~

2.2.2 Hollow Clay or Shale Brick

*12

Hollow clay or shale brick shall conform to ASTM C 652, Type HBS. Brick size shall be modular and the nominal size of the brick used shall be 57 mm (2-1/4 inches) thick, 92 mm (3-5/8 inches) wide, and 94 mm (7-5/8 inches) long. Where vertical reinforcement is shown in hollow brick, the minimum cell dimension shall be 64 mm (2-1/2 inches) and the units shall be designed to provide precise vertical alignment of the cells. Minimum compressive strength of the brick shall be 9.0 MPa (1350 psi).

2.3 CONCRETE BRICK

Concrete brick shall conform to ASTM C 55, Type I, Grade N. Concrete brick may be used where necessary for filling out in concrete masonry unit construction only where in finish construction. The units are not exposed to view or concealed by other finishes.

2.4 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 90, Type II, Lightweight. Cement shall have a low alkali content and be of one brand and shall meet all fire rating requirements shown on drawings.

2.4.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with

ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2.4.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 25 mm (1 inch). Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

2.4.3 Fire-Rated CMU

Concrete masonry units used in fire-rated construction shown on the drawings shall be of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated on the aggregate requiring the greater minimum equivalent thickness to produce the required fire rating.

TABLE I

FIRE-RATED CONCRETE MASONRY UNITS

See note (a) below

Minimum equivalent thickness in mm (inches) for fire rating of:

| Aggregate Type | 2 hours |
|---|---|
| Pumice | 75 (3.0) |
| Expanded slag | 85 (3.3) |
| Expanded clay, shale, or slate | 95 (3.7) |
| Limestone, scoria, cinders or unexpanded slag | 100 (4.0) |
| Calcareous gravel | 105 (4.2) |
| Siliceous gravel | 115 (4.5) |

(a) Minimum equivalent thickness shall equal net volume as determined in conformance with ASTM C 140 divided by the product of the actual length and height of the face shell of the unit in millimeters (inches). Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; the thickness of plaster or brick or other material in the assembly will be included in determining the equivalent thickness.

2.5 *OMITTED*
2.6 *OMITTED*
2.7 *OMITTED*

2.8 PRECAST CONCRETE ITEMS

Trim, keystones and splashblocks shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 28 MPa (4,000 psi) minimum conforming to Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE using 13 mm (1/2 inch) to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Clearance of 20 mm (3/4 inch) shall be maintained between reinforcement and faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 827 kPa (120 psi) for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or

steam-cured and shall then be aged under cover for 28 days or longer. Cast-concrete members weighing over 35 kg (80 pounds) shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises and shall be cast with drip grooves on the underside where units overhang walls. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

2.8.1 *Omitted*
2.8.2 *Omitted*

2.8.3 Splash Blocks

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

2.9 *OMITTED*

2.10 MORTAR

Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate. Mortar for prefaced concrete masonry unit wainscots shall contain aggregates with 100 percent passing the 2.36 mm (No. 8) sieve and 95 percent passing the 1.18 mm (No. 16) sieve. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.10.1 *Omitted*

2.10.2 Coloring
*12
Mortar coloring shall be added to the mortar used for exposed masonry surfaces to produce a uniform color ~~matching U.S. Beige 21A~~. Mortar coloring shall not exceed 3 percent of the weight of cement for carbon black and 10 percent of the weight of cement for all other pigments. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement.

2.11 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 200 and 250 mm (8 and 10 inches). Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

2.11.1 *Omitted*

2.11.2 Grout Barriers

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

## 2.12 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82. Anchors and ties shall be sized to provide a minimum of 16 mm (5/8 inch) mortar cover from either face.

### 2.12.1 Wire Mesh Ties

Wire mesh for tying 100 mm (4-inch) thick concrete masonry unit partitions to other intersecting masonry partitions shall be 13 mm (1/2 inch) mesh of minimum 16 gauge steel wire. Minimum lengths shall be not less than 300 mm (12 inches).

### 2.12.2 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 5 mm (3/16 inch) diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 100 mm (4 inches) wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 5 mm (3/16 inch) diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 13 mm (1/2 inch) eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 2 mm (1/16 inch). The pintle and eye elements shall be formed so that both can be in the same plane.

### 2.12.3 Dovetail Anchors

Dovetail anchors shall be of the flexible wire type, 5 mm (3/16 inch) diameter zinc-coated steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section. These anchors shall be used for anchorage of veneer wythes or composite-wall facings extending over the face of concrete columns, beams, or walls. Cells within vertical planes of these anchors shall be filled solid with grout for full height of walls or partitions, or solid units may be used. Dovetail slots are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

### 2.12.4 Adjustable Anchors

Adjustable anchors shall be 5 mm (3/16 inch) diameter steel wire, triangular-shaped. Anchors attached to steel shall be 38 x 3 x 300 MM diameter steel bars placed to provide 2 mm (1/16 inch) (play between flexible anchors and structural steel members. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich touch up paint.

### 2.12.5 Bar Positioners

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

## 2.13 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 16 mm (5/8 inch) cover from either face. The distance between crosswires shall not exceed 400 mm (16 inches). Joint reinforcement for straight runs shall be furnished in flat sections not less than 3 m (10 feet) long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

## 2.14 REINFORCING STEEL BARS AND RODS

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

## 2.15 CONTROL JOINT KEYS

Control joint keys shall be a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D 2000 or polyvinyl chloride conforming to ASTM D 2287. The material shall be resistant to oils and solvents. The control joint key shall be provided with a solid shear section not less than 16 mm (5/8 inch) thick and 10 mm (3/8 inch) thick flanges, with a tolerance of plus or minus 2 mm (1/16 inch). The control joint key shall fit neatly, but without forcing, in masonry unit jamb sash grooves. The control joint key shall be flexible at a temperature of minus 34 degrees C (minus 30 degrees F) after 5 hours exposure, and shall have a durometer hardness of not less than 70 when tested in accordance with ASTM D 2240.

## 2.16 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07920 JOINT SEALING.

## 2.17 INSULATION

### 2.17.1 Rigid Board-Type Insulation

Rigid board-type insulation shall be extruded polystyrene, polyurethane, or polyisocyanurate. Polystyrene shall conform to ASTM C 578. Polyurethane or polyisocyanurate shall conform to ASTM C 1289, Type I, Class 2, faced with aluminum foil on both sides of the foam. The insulation shall be a standard product and shall be marked with not less than the manufacturer's trademark or name, the specification number, the permeance and R-values.

#### 2.17.1.1 Insulation Thickness and Air Space

The cavity space shall allow for a maximum insulation thickness of 50 mm (2 inches) and a minimum air space of 20 mm (3/4 inch).

#### 2.17.1.2 Aged R-Value

The insulation shall provide a minimum aged R-value of 2 (11) for the overall thickness. The aged R-value shall be determined at 24 degrees C (75 degrees F) in accordance with the appropriate referenced specification. The stated R-value of the insulation shall be certified by an independent testing

laboratory or certified by an independent Registered Professional Engineer if tests are conducted in the manufacturer's laboratory.

2.17.1.3 Recovered Material

Insulation shall contain the highest practicable percentage of recovered material derived from solid waste (but material reused in the manufacturing process cannot be counted toward the percentage of recovered material). Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. The polyurethane or polyisocyanurate foam shall have a minimum recovered material content of 9 percent by weight of the core material.

2.17.2 Insulation Adhesive

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

2.18 FLASHING

Flashing shall be as specified in Section 07600 SHEET METALWORK, GENERAL.

2.19 WEEP HOLE VENTILATORS

Weephole ventilators shall be prefabricated aluminum grill type vents designed to prevent insect entry with maximum air entry. Ventilators shall be sized to match modular construction with a standard 10 mm (3/8 inch) mortar joint.

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 37 degrees C (99 degrees F) in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 1.2 m (4 feet) ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 4 degrees C (40 degrees F), a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

3.1.2.1 Preparation

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

a. Air Temperature 4 to 0 degrees C (40 to 32 Degrees F). Sand or mixing water shall be heated to produce mortar temperatures between 4 degrees C and 49 degrees C (40 degrees F and 120 degrees F).

b. Air Temperature 0 to minus 4 degrees C (32 to 25 Degrees F). Sand and mixing water shall be heated to produce mortar temperatures between 4 degrees C and 49 degrees C (40 degrees F and 120 degrees F). Temperature of mortar on boards shall be maintained above freezing.

c. Air Temperature minus 4 to minus 7 degrees C (25 to 20 Degrees F). Sand and mixing water shall be heated to provide mortar temperatures between 4 degrees C and 49 degrees C (40 degrees F and 120 degrees F). Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 24 km/hour (15 mph).

d. Air Temperature minus 7 degrees C (20 Degrees F) and below. Sand and mixing water shall be heated to provide mortar temperatures between 4 degrees C and 49 degrees C (40 degrees F and 120 degrees F). Enclosure and auxiliary heat shall be provided to maintain air temperature above 0 degrees C (32 degrees F). Temperature of units when laid shall not be less than minus 7 degrees C (20 degrees F).

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

a. Mean daily air temperature 4 degrees C to 0 degrees C (40 degrees F to 32 degrees F). Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.

b. Mean daily air temperature 0 degrees C to minus 4 degrees C (32 degrees F to 25 degrees F). Masonry shall be completely covered with weather-resistant membrane for 24 hours.

c. Mean Daily Air Temperature minus 4 degrees C to minus 7 degrees C (25 Degrees F to 20 Degrees F). Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.

d. Mean Daily Temperature minus 7 degrees C (20 Degrees F) and Below. Masonry temperature shall be maintained above 0 degrees C (32 degrees F) for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running or bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 13 mm (1/2 inch). Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be free from chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 13 mm (1/2 inch) into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. In double wythe construction, the inner wythe may be brought up not more than 400 mm (16 inches) ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe,

and filling shall not lag the laying of the facing wythe by more than 200 mm (8 inches).

3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 3 mm (1/8 inch). Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.2 Forms and Shores

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

3.2.3 Concrete Masonry Units

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

3.2.4 Clay or Shale Brick Units

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

3.2.4.1 Wetting of Units

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

3.2.4.2 Solid Units

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

3.2.4.3 Hollow Units

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

3.2.5 Tolerances

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

TABLE II
TOLERANCES

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

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

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

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

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

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

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

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

Variations from horizontal lines

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

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

| | |
|---|---|
| Minus | 6 mm |
| Plus | 13 mm |

3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 300 mm (12 inches) wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.7 Jointing

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

3.2.7.1 Flush Joints

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

3.2.7.2 Tooled Joints

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

3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm (3/8 inch). On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm (3/8 inch).

3.2.8 Joint Widths

Joint widths shall be as follows:

3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have 10 mm (3/8 inch) joints.

3.2.8.2 *Omitted*

3.2.8.3 Brick

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

3.2.9 Embedded Items

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

3.2.10 Unfinished Work

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

3.2.11 Masonry Wall Intersections

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

3.2.12 Partitions

Partitions shall be continuous from floor to roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 100 mm (4 inches) above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Interior partitions having 100 mm (4-inch) nominal thick units shall be tied to intersecting partitions of 100 mm (4-inch) units, 125 mm (5 inches) into partitions of 150 mm (6-inch) units, and 175 (7 inches) into partitions of 200 mm (8-inch) or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units may be used. Interior partitions having masonry walls over 100 mm (4 inches) thick shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

3.3 ANCHORED VENEER CONSTRUCTION

The inner and outer wythes shall be completely separated by a continuous airspace as shown on the drawings. Both the inner and the outer wythes shall be laid up together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, through-wall flashings shall be protected from damage until they are fully enclosed in the wall. The airspace between the wythes shall be kept clear and free of mortar droppings by temporary wood strips laid on the wall ties and carefully lifted out before placing the next row of ties. A coarse gravel or drainage material shall be placed behind the weep holes in the cavity to a minimum depth of 100 mm (4 inches) of coarse aggregate or 250 mm (10 inches) of drainage material to keep mortar droppings from plugging the weep holes.

3.4 WEEP HOLES

Weep holes shall be provided not more than 600 mm (24 inches) on centers in mortar joints of the exterior wythe above wall flashing, over foundations, bond beams, and any other horizontal interruptions of the cavity. Weep holes shall be constructed using weep hole ventilators. Other approved weep hole devices may be used for providing weep holes. Weep holes shall be kept free of mortar and other obstructions.

3.5 *OMITTED*
3.6 *OMITTED*
3.7 *OMITTED*
3.8 *OMITTED*

3.9 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that

has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

## 3.10 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 50 mm (2 inches) of tops of walls.

### 3.10.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 13 mm (1/2 inch) shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

### 3.10.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement.

## 3.11 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 400 mm (16 inches) on center or as indicated. Reinforcement shall be lapped not less than 150 mm (6 inches). Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 16 mm (5/8 inch) cover to either face of the unit.

## 3.12 PLACING GROUT

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

### 3.12.1 *Omitted*

### 3.12.2 Horizontal Grout Barriers

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

### 3.12.3 Grout Holes and Cleanouts

#### 3.12.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 400 mm (16 inches) on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 100 mm (4 inches) in diameter or 75 by 100 mm (3 by 4 inches) in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

3.12.4 Grouting Equipment

3.12.4.1 Grout Pumps

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

3.12.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

3.12.5 Grout Placement

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

3.12.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 13 mm (1/2 inch) into the grout space shall be removed before beginning the grouting operation. Grout pours 300 mm (12 inches) or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 300 mm (12 inches) in height shall be consolidated by mechanical vibration and reconsolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

| Maximum Grout Pour | Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (mm) (1,2) |
|---|---|

| Height (m) (4) | Grout Type | Grouting Procedure | Hollow-unit Masonry |
|---|---|---|---|
| 0.3 | Fine | Low Lift | 40 x 50 |
| 1.5 | Fine | Low Lift | 50 x 75 |

Notes:
(1) The actual grout space or cell dimension must be larger than the sum of the following items:
a) The required minimum dimensions of total clear areas given in the table above;
b) The width of any mortar projections within the space;
c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.
(2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 20 mm (3/4 inch) or greater in width.
(3) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.13 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 13 mm (1/2 inch) shall be maintained between reinforcement and interior faces of units.

3.14 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using sash jamb units with control joint key in accordance with the details shown on the drawings. Sash jamb units shall have a 19 by 19 mm (3/4 by 3/4 inch) groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 20 mm (3/4 inch); backer rod and sealant shall be installed in accordance with Section 07920 JOINT SEALING. Exposed interior control joints shall be raked to a depth of 6 mm (1/4 inch). Concealed control joints shall be flush cut.

3.15 BRICK EXPANSION JOINTS AND CONCRETE MASONRY VENEER JOINTS

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

3.16 *OMITTED*

3.17 LINTELS

3.17.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 600 mm (24 inches), whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 15 mm (1/2 inch) above the bottom inside surface of the lintel unit.

3.17.2 Steel Lintels

Steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel shall have a minimum bearing length of 200 mm (8 inches) unless otherwise indicated on the drawings.

3.18 *OMITTED*

3.19 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.19.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete walls shall be with dovetail anchors spaced not over 400 mm (16 inches) on centers vertically and 600 mm (24 inches) on center horizontally.

3.19.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 400 mm (16 inches) on centers vertically, and if applicable, not over 600 mm (24 inches) on centers horizontally.

3.20 *OMITTED*

3.21 INSULATION

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

3.22 SPLASH BLOCKS

Splash blocks shall be located as shown.

3.23 POINTING AND CLEANING

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

tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

### 3.23.1 Concrete Masonry Unit and Concrete Brick Surfaces

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

### 3.23.2 Clay or Shale Brick Surfaces

Exposed clay or shale brick masonry surfaces shall be cleaned as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, the sample panel of similar material shall be examined for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, the method of cleaning shall be changed to assure that the masonry surfaces in the structure will not be adversely affected. The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 30 milliliters (1/2 cup) trisodium phosphate and 30 milliliters (1/2 cup) laundry detergent to 1 liter (1 gallon) of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

## 3.24 BEARING PLATES

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

## 3.25 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 600 mm (2 feet) down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

## 3.26 TEST REPORTS

### 3.26.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 13 to 16 mm (1/2 to 5/8 inch) thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

### 3.26.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 13.8 MPa (2,000 psi) at 28 days.

### 3.26.3 Efflorescence Test

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

-- End of Section --

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-04 | (1989) Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design |
| AISC S303 | (1992) Code of Standard Practice for Steel Buildings and Bridges |
| AISC S329 | (1986) Allowable Stress Design Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 6 | (1993b) General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use |
| ASTM A 36 | 1993a) Structural Steel |
| ASTM A 307 | (1993a) Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength |
| ASTM A 325 | (1993) 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 501 | (1993) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing |
| ASTM A 563 | (1993) Carbon and Alloy Steel Nuts |
| ASTM F 436 | (1993) Hardened Steel Washers |
| ASTM F 844 | (1990) Washers, Steel, Plain (Flat), Unhardened for General Use |
| ASTM F 959 | (1993) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|---|---|
| ASME B18.21.1 | (1990) 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-01 and AISC-02. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Officer. AISC-04 shall govern the work. Welding shall be in accordance with AWS D1.1. High-strength bolting shall be in accordance with AISC S329.

1.3 SUBMITTALS

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

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.

1.4  STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

PART 2  PRODUCTS

2.1  STRUCTURAL STEEL

2.1.1  Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36.

2.2  STRUCTURAL TUBING

Structural tubing shall conform toASTM A 500, Grade B.

2.3  OMITTED.

2.4  OMITTED.

2.5  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 .

2.6  CARBON STEEL BOLTS

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

2.7  NUTS DIMENSIONAL STYLE

Carbon steel nuts shall be hex style when used with ASTM A 307 bolts or heavy hex style when used with ASTM A 325 bolts.

2.8  WASHERS

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

2.9  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 (500 micro inches) as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6.

Structural steelwork 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 Base Plates and Bearing Plates

Column base plates for columns and bearing plates for beams, girders, and similar members shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned, but prior to placing superimposed loads. Separate setting plates under column base plates will not be permitted. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

### 3.2.3 Field Welded Connections

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

### 3.2.4 Field Priming

After erection, the field bolt heads and 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.

-- End of Section --

SECTION 05210

STEEL JOISTS

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.

SD-13 Certificates

Steel Joists; FIO.

Certificates stating that the steel joists 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 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 OMITTED
2.3 OMITTED

## 2.4 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.

## 2.5 SHOP PAINTING

Joists and accessories shall be shop painted with a rust-inhibiting primer paint. For joists 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

Installation of joists shall be in accordance with the standard specification under which the member was produced. Joists shall be handled in a manner to avoid damage. Damaged joists 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 shall be accurately set, and end anchorage shall be in accordance with the standard specification under which the joists were produced. For spans over 12 m (40 feet) through 18 m (60 feet) one row of bridging nearest midspan shall be bolted diagonal bridging; for spans over 18 m (60 feet) bolted diagonal bridging shall be used instead of welded horizontal 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 cleaned and touched up with the same type of paint used in the shop painting.

## 3.2 BEARING PLATES

Bearing plates shall be provided with full bearing after the supporting members have been plumbed and properly positioned, but prior to placing superimposed loads. 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.

-- End of Section --

SECTION 05300

STEEL DECKING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

| | |
|---|---|
| AISC-04 | (1989) Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design |

AMERICAN IRON AND STEEL INSTITUTE (AISI)

| | |
|---|---|
| AISI SG-673 | (1987) Cold-Formed Steel Design Manual |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 108 | (1993) Steel Bars, Carbon, Cold Finished, Standard Quality |
| ASTM A 446 | (1993) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality |
| ASTM A 525 | (1993) General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process |
| ASTM A 570 | (1992; R 1993) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality |
| ASTM A 611 | (1994) Steel, Sheet, Carbon, Cold-Rolled, Structural Quality |
| ASTM A 780 | (1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings |

STEEL DECK INSTITUTE (SDI)

| | |
|---|---|
| SDI-02 | (1987; Amended 1991) Diaphragm Design Manual |
| SDI Pub No 28 | (1992) Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution |

1.2 SUBMITTALS

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

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

SD-01 Data

Deck Units; FIO.

Design computations for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications.

SD-04 Drawings

Deck Units; GA. Accessories; GA. Attachments; GA. Holes and Openings; GA.

Drawings shall include type, configuration, structural properties, location and necessary details of deck units, accessories, and supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of welded [or fastener] connections; and the manufacturer's erection instructions.

SD-13 Certificates

Deck Units; FIO.

Manufacturer's certificates attesting that the decking material meets the specified requirements.

## 1.3 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated and stored under a weathertight covering permitting good air circulation. Finish of deck units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

# PART 2 PRODUCTS

## 2.1 DECK UNITS

Deck units shall conform to SDI Pub No 28. Panels of maximum possible lengths shall be used to minimize end laps. Fabricate deck units in lengths to span three or more supports with flush, telescoped, or nested 50.8 mm (2-inch) laps at ends, and interlocking or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI SG-673, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

### 2.1.1 Roof Deck

Steel deck used in conjunction with insulation and built-up roofing shall conform to ASTM A 446, or ASTM A 611. Roof deck units shall be fabricated. The steel design thickness required by the design drawings and shall be zinc-coated in conformance with ASTM A 525, G90 coating class.

## 2.2 OMITTED

## 2.3 ADJUSTING PLATES

Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be the same thickness and configuration as the deck units.

## 2.4 CLOSURE PLATES

### 2.4.1 Closure Plates for Roof Deck

Voids above interior walls shall be closed with sheet metal where shown. Open deck cells at parapets, end walls, eaves and openings through roofs shall be closed with sheet metal. Sheet metal shall be same thickness as deck units.

## 2.5 ACCESSORIES

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 1.204 mm (0.0474 inch); cant strip, 0.749 mm (0.0295 inch); other metal accessories, 1.204 mm (0.0474 inch); unless otherwise indicated. Accessories shall include but not be limited to saddles, cant strips, butt cover plates, underlapping sleeves and ridge and valley plates.

# PART 3 EXECUTION

## 3.1 ERECTION

Erection of deck and accessories shall be in accordance with FIO and the approved detail drawings. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or deformed shall not be installed. The deck units shall be placed on secure supports, properly adjusted and aligned at right angles to supports before being permanently secured in place. The deck shall not be FIO used for storage or as a working platform until the units have been secured in position. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended directly from the steel deck.

## 3.2 OMITTED

## 3.3 ATTACHMENTS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be fastened with screws to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No 28. Deck ends shall be lapped 50 mm (2 inches). All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI-02.

## 3.4 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings, specifications and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 150 mm (6 inches) across require no reinforcement. Holes and openings 150 to 300 mm (6 to 12 inches) across shall be reinforced by 1.204 mm (0.0474 inch) thick steel sheet at least 300 mm (12 inches) wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 150 mm (6 inches) on center. Holes and openings larger than 300 mm (12 inches) shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists.

Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.

-- End of Section --

SECTION 05450

PRE-ENGINEERED LIGHT GAUGE STEEL TRUSSED FRAMES

PART 1 GENERAL

1.1 SCOPE

1.2 RELATED WORK SPECIFIED ELSEWHERE

The work under this section consists of furnishing and installing all pre-engineered light gauge trusses as shown on drawings and as specified herein including headers, outriggers, supplemental rafters and incidental framing for a complete assemble within the extent shown on the drawings.

Pre-engineered light gauge steel trusses include planar structural units consisting of welded or screwed connected members which are fabricated, cut and assembled prior to delivery or at the job site.

Types of prefabricated trusses include:

Gable-shaped trusses.
Monopitch trusses.
Irregular shaped trusses.
Supplemental headers, studs and other incidental framed assemblies.

1.3 REFERENCES

The following documents of the issue in effect on date of material procurement, referred to thereafter by basic designation only form a part of this specification to the extent indicated by referenced thereto.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-673 Specification for the Design of Cold-Formed Steel Structural Members, 1986 Edition with 1989 Amendments.

AMERICAN SOCIETY OF TESTING MATERIALS (ASTM)

ASTM A 446 (1989) Specification for Steel sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Physical (Structural) Quality.
Grade A, Fy = 33 ksi: 18 gauge and lighter
Grade D, Fy = 50 ksi 16 gauge and heavier
Galvanizing: G60 coating class

AMERICAN WELDING SOCIETY

AWS D1.1-90 Structural Welding Code - Steel

AWS D1.3-89 Structural Welding Code - Sheet Steel

1.3 FABRICATOR'S QUALIFICATIONS

Trusses shall be designed, fabricated, and erected by a firm which has a record including a minimum of 5 years of successfully fabricating trussed assemblies similar to scope required and which practices a quality control program which includes inspection by an independent inspection and testing agency.

1.4 SUBMITTALS

1.4.1 Product Data; FIO.

Submit fabricator's technical data covering materials, shapes, hardware, fabrication process, handling and erection.

1.4.2 Certificate of Compliance; FIO.

Submit certificate, signed by an officer of fabricating firm and professional engineer whose seal is on the shop drawings and calculations, indicating trusses and related assemblies to be supplied for this project comply with all indicated requirements on the shop drawings and contract documents. See paragraph 3.1.

1.4.3 Shop Drawings; GA.

Submit shop drawings showing shapes and dimensions of members to be used including pitch, span, camber configuration and spacing for each type or configuration of truss required. Show all bearing and anchorage details. Specify and detail all supplemental strapping, bracing clips and other accessories required for proper installation. Shop drawings shall include all placement sequences and instructions.

1.4.4 Design Analysis; GA.

Trusses, roof and ceiling framing, bracing, etc. shall be designed by a structural engineer. Submit design analysis indicating loading, section properties, allowable stress, stress diagrams, connections, bracing and calculations, and similar information needed for analysis an to ensure trusses comply with requirements. All designs shall bear the name and seal of a structural engineer licensed to practice in the state where trusses are to be erected.

1.4.5 Basis of Design

Basis of design is indicated on drawings.

1.5 DELIVERY, STORAGE, HANDLING

Handle and store truss materials and accessories, and in accordance with manufacturer's instructions to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure. Storage shall be off-ground in a dry ventilated space or protect with waterproof coverings.

Time fabrication and erection or trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

PART 2 PRODUCTS

2.1 FRAMING COMPONENTS

2.1.1 Available Manufacturer

Subject to compliance with requirements shown on drawings and specifications, framing shapes and components for pre-engineered light gauge prefabricated steel trusses shall be as manufactured or recommended by approved manufacturer.

2.1.2 Design, Analysis and Computation

Design, analysis, and computation of section properties shall be in conformance

with the specification for the Design of cold-Formed Steel Structural Members of the American Iron and Steel Institute.

2.1.3 Galvanized Structural Members

2.1.3.1 All galvanized structural members shall conform to A-653/A-653M, structural quality grade 230 (33 ksi); Grade 275 (40 ksi) or Grade 345 (50 ksi) Class 1 or Class 2.

2.1.3.2 Studs shall be C- shaped with 41 mm wide flange with 13 mm return lip.

2.1.3.3 Provide all angles, clips, and other miscellaneous pieces necessary to attach light gauge framing panels to building structure or to attach other materials to light gauge framing panels.

2.1.4 Steel Members

All steel members shall be galvanized with a ASTM A525, G60 coating minimum.

2.1.5 Field paint shall be zinc rich paint or a galvanizing repair paint.

2.2 FASTENERS

Framing components shall be fastened to each other by screws or welding as recommended by approved manufacturer.

2.2.1 Screws shall be No. 12 - 14 framing self drilling screws minimum.

2.2.2 Welds shall be in conformance with AWS D1.1 and AWS D1.3.

PART 3 EXECUTION

3.1 FABRICATION

3.1.1 Light gauge steel prefabricated trusses shall be fabricated either on or off site prior to erection.

3.1.2 All framing components shall be straight and true prior to fabrication. Flattening or straightening of components shall be done by a process not injurious to materials.

3.1.3 All framing components shall be cut neatly to fit squarely against abutting members.

3.1.4 All components shall be set square in line and shall be held firmly in position until properly fastened.

3.1.5 All panel components shall be joined by screws or welding.

3.1.6 Finished assemblies shall be free from twists, bends, or open joints with all members straight, square, and true to line.

3.1.7 Welds shall be made by certified welders. Touch up all welds with field paint.

3.1.8 The fabricator shall fabricate one truss of each type for inspection by the professional engineer whose seal is on the shop drawings and calculations prior to fabricating the remaining trusses.

3.1.9 Provide web stiffeners and reinforcement at reaction points where required by analysis or to suit details.

3.2 ERECTION

3.2.1 Prefabricated trusses shall be braced against racking. Lifting of trusses shall be done so as to not cause local distortion in any member.

3.2.2 All light gauge steel framing shall be erected by approved methods using equipment of adequate capacity to safely perform the work.

3.2.3 The Contractor is responsible for checking dimensions and assuring fit of all members and panels before erection begins.

3.2.4 All work shall be erected plumb and level and to dimensions, spacings and elevations indicated on drawings.

3.2.5 Members shall be on size and spacing shown on the approved shop drawings.

3.2.6 Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members or joists by out-of-plane end or other causes.

3.2.7 Provide temporary bracing as require to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.

3.2.8 Anchor trusses securely at all bearing points to comply with methods and details indicated.

3.2.9 Install permanent bracing and related components to enable trusses to maintain design spacing, withstand live and dead loads including lateral loads, and to comply with other indicated requirements.

3.2.10 Do not cut or remove truss members.

END OF SECTION

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 (1993a) 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 (1993) Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A 446 (1993) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

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 525 (1993) General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

ASTM B 26 (1992a) Aluminum-Alloy Sand Castings

ASTM B 221 (1993) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

ASTM B 429 (1992a) 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

FEDERAL SPECIFICATIONS (FS)

FS AA-S-271 (Rev D; Am 1) Shelving, Storage and Display, Steel, Interchangeable, Nut and Bolt Type

FS AA-S-1048 (Basic) Shelving, Storage and Display, Steel, Clip Type

FS RR-C-271 (Rev D) Chains and Attachments, Welded and Weldless

FS RR-G-1602 (Rev C) Grating, Metal, Other Than Bar Type (Floor, Except for Naval Vessels)

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM-01 (1988) Metal Finishes Manual for Architectural and Metal Products

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 - Metal Handrails, Metal Frames for Overhead Roll-Up Doors, Pipe Guards, Downspout Boots, Metal Corner Guards, Wire Mesh Partitions (Additive No. 2)

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: Metal Frames for Overhead Roll-Up Doors.

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123, ASTM A 446, or ASTM A 525, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 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 *OMITTED*

2.2 SHOP PAINTING

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

2.3 *OMITTED*
2.4 *OMITTED*

2.5 CLEANOUT DOORS

Cleanout doors shall be galvanized, shall be provided with frames, and unless otherwise indicated, shall be sized to match flues. The frames shall have a continuous flange and anchors for securing into masonry. The doors shall be smokeproof, hinged, and shall have fastening devices to hold the door closed.

2.6 *OMITTED*

2.7 CORNER GUARDS AND SHIELDS

Corner guards and shields for jambs and sills of openings and edges of platforms shall be steel shapes and plates anchored in masonry or concrete with welded steel straps or end weld stud anchors. Corner guards for use with glazed or ceramic tile finish on walls shall be formed of 1.5875 mm (0.0625

inch) thick corrosion-resisting steel with polished or satin finish, shall extend 1.5 m (5 feet) above the top of cove base or to the top of the wainscot, whichever is less, and shall be securely anchored to the supporting wall. Corner guards on exterior shall be galvanized. Interior corner guards shall be stainless steel.

2.8 DOOR GUARDS

Door guards shall be constructed of woven steel wire or expanded metal framed with structural steel shapes. Expanded metal guards shall be of 38 mm (1-1/2 inch) No. 10 mesh, welded to 25 by 25 by 3 mm (1 by 1 by 1/8 inch) angle frame. Woven-wire panel shall be of 10 gauge, 38 mm (1-1/2 inch) mesh secured through weaving to 25 mm (1 inch) channel frame or around a 10 mm (3/8 inch) round bar frame. Corners of frames shall be mitered and welded. Guards shall be sized as indicated.

2.9 PIPE GUARDS

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53, Type E or S, weight STD, black finish.

2.10 DOWNSPOUT BOOTS

Downspout boots shall be cast iron with receiving bells sized to fit downspouts.

2.11 EXPANSION JOINT COVERS

Expansion joint covers shall be constructed of extruded aluminum with anodized satin finish for walls and ceilings and with standard mill finish for floor covers and exterior covers. Plates, backup angles, expansion filler strip and anchors shall be designed as indicated. Expansion joint system shall provide a 1/2 hour fire rating.

2.12 *OMITTED*
2.13 *OMITTED*
2.14 *OMITTED*
2.15 *OMITTED*

2.16 HANDRAILS

Handrails shall be designed to resist a concentrated load of 890 N (200 pounds) in any direction at any point of the top of the rail or 292 Newtons per meter (20 pounds per foot) applied horizontally to top of the rail, whichever is more severe.

2.16.1 Steel Handrails, Including Carbon Steel Inserts

Steel handrails, including inserts in concrete, shall be structural tubing conforming to ASTM A 500, Grade A or B of equivalent strength. Steel railings shall be 40 mm (1-1/2 inch nominal size. Railings shall be hot-dip galvanized and shop painted. Pipe collars shall be hot-dip galvanized 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 (3/8 inch) hexagonal recessed-head setscrews.

(2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and

grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 150 mm (6 inches) long.

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

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

2.17 *OMITTED*
2.18 *OMITTED*
2.19 *OMITTED*
2.20 *OMITTED*

2.21 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.

2.22 PARTITIONS, DIAMOND MESH TYPE

Partitions shall be constructed of metal fabric attached to structural steel framing members. Fabric shall be 10 gauge steel wires woven into 38 mm (1-1/2 inch) diamond mesh with wire secured through weaving channels and expanded metal of 38 mm (1-1/2 inch), No. 10 diamond mesh secured to channel frame by welding. See plans for location of each type. Framing members shall be channels 38 by 3 mm (1-1/2 by 1/8 inch) minimum size. 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 painted.

2.23 ROLL-UP FLOOR MATS

Roll-up mats shall be of aluminum construction with serrated aluminum surface. Roll-up mats shall be for use in recessed area. See construction details of recessed areas as shown on the drawings.

2.24 *OMITTED*

2.25 GUN LOCKING CHAINS

Safety chains shall be stainless welded steel, proof coil chain in accordance with FS RR-C-271, Type I, Class 4. Safety chains shall be straight link style, 5 mm (3/16 inch) diameter, minimum 80 links per meter (24 links per foot) and with bolt type snap hooks on each end. Eye bolts for attachment of chains to wall shall be stainless 10 mm (3/8 inch) bolt with 19 mm (3/4 inch) eye at 1219 mm o.c., anchored as indicated. Two chains shall be furnished for each wall of vault.

2.26 *OMITTED*

2.27 SHELVING

Shelving shall conform to FS AA-S-271, Kind 1, Class 1, Type III. Minimum dimensions and number of shelves shall be as indicated.

2.28 *OMITTED*

2.29 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 (2- by 1/4 by 12-inch) bent, adjustable metal anchors spaced not over 760 mm (2 feet 6 inches) on centers. Provision shall be made to stiffen the top member for all spans over 900 mm (3 feet). Continuous door stops shall be made of 38 by 16 mm (1-1/2 by 5/8 inch) bars.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

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

3.2 REMOVABLE ACCESS PANELS

A removable access panel not less than 300 by 300 mm (12 by 12 inches) shall be installed directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

3.3 *OMITTED*
3.4 *OMITTED*

3.5 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 having a compressive strength of 21 MPa (3,000 psi)].

3.6 INSTALLATION OF DOWNSPOUT BOOTS

Downspout boots shall be secured to building through integral lips with appropriate fasteners and expansion shields.

3.7 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.

3.7.1 Installation of Steel Handrails

Installation shall be in pipe sleeves embedded in concrete and filled with molten lead or sulphur with anchorage covered with standard pipe collar pinned to post. Rail ends shall be secured by vertical post anchored in concrete slab.

3.8 *OMITTED*
3.9 *OMITTED*
3.10 *OMITTED*

3.11 RECESSED FLOOR MATS

Contractor shall verify field measurements prior to releasing materials for fabrication by the manufacturer. A mat frame shall be used to ensure recess accuracy in size, shape and depth. Drain pit shall be formed by blocking out concrete when frames are installed. Pit shall be dampproofed after concrete has set. Frames shall be assembled onsite and installed so that upper edge will be level with finished floor surface. A cement base shall be screeded inside the mat recess frame area using the edge provided by the frame as a guide. The frame shall be anchored into the cement with anchor pins a minimum of 610 mm (24 inches) on centers.

3.12 MOUNTING OF GUN LOCKING CHAINS

Safety chains shall be mounted 1220 mm (4 feet) and 610 mm (2 feet) above the floor.

3.13 *OMITTED*

3.14 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 (18-inch) centers, assuring in either case full contact with the frame. Any necessary reinforcements shall be made and the frames shall be drilled and tapped as required for hardware.

-- End of Section --

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN FOREST AND PAPER ASSOCIATION (AFPA)

AFPA-T901 (1991; Supple 1993; Addenda April 1995) National Design Specification for Wood Construction

AFPA T11-WCD1 (1988) Manual for Wood Frame Construction

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1982; R 1988) Basic Hardboard

AHA A194.1 (1985) Cellulosic Fiberboard

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

AITC-01 (1994) Timber Construction Manual

AITC 109 (1990) Standard for Preservative Treatment of Structural Glued Laminated Timber

AITC 111 (1979) Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection

AITC A190.1 (1992) Structural Glued Laminated Timber

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1 (1993) Particleboard

AMERICAN PLYWOOD ASSOCIATION (APA)

APA E30 (1994) Design/Construction Guide, Residential and Commercial

APA E445 (1991; Rev May 1991) Performance Standards and Policies for Structural-Use Panels

APA V450 (1994) Source List - Adhesives for APA Glued Floor System

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 307 (1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM C 79 (1994) Gypsum Sheathing Board

ASTM C 208 (1995) Cellulosic Fiber Insulating Board

ASTM C 516 (1980; R 1990) Vermiculite Loose Fill Thermal Insulation

ASTM C 518 (1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Heat Flow Meter Apparatus

ASTM C 549 (1981; R 1995) Perlite Loose Fill 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 578 (1992) Rigid, Cellular Polystyrene Thermal Insulation

ASTM C 591 (1994) Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation

ASTM C 612 (1993) Mineral Fiber Block and Board Thermal Insulation

ASTM C 665 (1994) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

ASTM C 726 (1993) Mineral Fiber Roof Insulation Board

ASTM C 739 (1991) Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation

ASTM C 764 (1994) Mineral Fiber Loose-Fill Thermal Insulation

ASTM C 1013 (1994) Membrane-Faced Rigid Cellular Polyurethane Roof Insulation

ASTM C 1136 (1992) Flexible, Low Permeance Vapor Retarders for Thermal Insulation

ASTM C 1289 (1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

ASTM D 2898 (1994) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing

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

ASTM E 96 (1995) Water Vapor Transmission of Materials

ASTM E 154 (1988; R 1993) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

ASTM F 547 (1977; R 1990) Definitions of Terms Relating to Nails for Use with Wood and Wood-Base Materials

AMERICAN WOOD PRESERVERS' ASSOCIATION (AWPA)

AWPA C2 (1995) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes

AWPA C9 (1995) Plywood - Preservative Treatment by Pressure Processes

AWPA C20 (1993) Structural Lumber - Fire-Retardant Treatment by Pressure Processes

AWPA C27 (1993) Plywood - Fire-Retardant Treatment by Pressure Processes

AWPA C28 (1995) Standard for Preservative Treatment of Structural Glued Laminated Members and Laminations Before Gluing of Southern Pine, Coastal Douglas Fir, Hemfir and Western Hemlock by Pressure Processes

AWPA M4 (1995) Standard for the Care of Preservative-Treated Wood Products

AWPA P5 (1995) Standards for Waterborne Preservatives

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA-RIS-01-SS (1995) Standard Specifications for Grades of California Redwood Lumber

CODE OF FEDERAL REGULATION (CFR)

16 CFR 1209 Interim Safety Standard for Cellulose Insulation

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1983) Construction and Industrial Plywood

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA-01 (1994) Rules for the Measurement & Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA-01 (1993) Standard Grading Rules for Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA-01 (1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB-1001 (1994) Standard Grading Rules for Southern Pine Lumber

TRUSS PLATE INSTITUTE (TPI)

TPI 85 (1985; Errata; Supple 1987; Addenda QST-88 (Appx P)) Design Specification for Metal Plate Connected Wood Trusses

TPI QST-88 (1988) Quality Standard for Metal Plate Connected Wood Trusses (Addendum (Appx P) to TPI-85)

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1993) Grading Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01 (1991; Supple No. 3) Western Lumber Grading Rules 91

## 1.2 SUBMITTALS

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

SD-01 Data

Structural Wood Members; FIO.

Design analysis and calculations of structural laminated members, fabricated wood trusses, and other fabricated structural members showing design criteria used to accomplish the applicable analysis.

Product Installations; FIO.

List containing name and location of successful installation of similar type of fabricated structural members specified herein.

SD-04 Drawings

Structural Wood Members; FIO. Installation of Framing; FIO.

Drawings of structural laminated members, fabricated wood trusses, engineered wood joists and rafters, and other fabricated structural members indicating materials, shop fabrication, and field erection details; including methods of fastening.

SD-13 Certificates

Grading and Marking; FIO.

Manufacturer's certificates (audited by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked or exempt from being grade marked meet the specified requirements. Certificate of Inspection issued for grade marked material by an American Lumber Standards Committee (ALSC) recognized lumber inspection agency prior to shipment.

Insulation; FIO.

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

## 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity. Laminated timber shall be handled and stored in accordance with AITC 111.

# PART 2 PRODUCTS

## 2.1 LUMBER AND SHEATHING

### 2.1.1 Grading and Marking

#### 2.1.1.1 Lumber Products

Solid sawn and finger-jointed lumber shall bear an authorized gradestamp or grademark recognized by ALSC, or an ALSC recognized certification stamp, mark,

or hammerbrand. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

2.1.1.2 *Omitted*

2.1.1.3 Plywood and other Sheathing Products

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. Except for plywood, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Treatment

Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil. Except as specified for all-heart material of the previously mentioned species, the following items shall be treated:

a. Wood members in contact with or within 455 mm (18 inches) of soil.

b. Wood members in contact with water.

c. Wood members exposed to the weather including those used in built-up roofing systems or as nailing strips or nailers over fiberboard or gypsum-board wall sheathing as a base for wood siding.

d. Wood members set into concrete regardless of location, including flush-with-deck wood nailers for roofs.

e. Wood members in contact with concrete that is in contact with soil or water or that is exposed to weather.

2.1.3.1 Lumber and Timbers

Lumber and timbers shall be treated in accordance with AWPA C2 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

a. 4 kg per cubic meter (0.25 pcf) intended for above ground use.

b. 6.4 kg per cubic meter (0.40 pcf) intended for ground contact and fresh water use.

2.1.3.2 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

a. 4 kg per cubic meter (0.25 pcf) intended for above ground use.

b. 6.4 kg per cubic meter (0.40 pcf) intended for ground contact and fresh water use.

2.1.4 Moisture Content

At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

a. Treated and Untreated Lumber Except Roof Planking:

100 mm (4 inches) or less, nominal thickness, 19 percent maximum. 125 mm (5 inches) or more, nominal thickness, 23 percent maximum in a 75 mm (3-inch) perimeter of the timber cross-section.

b. Roof Planking: 15 percent maximum.

c. Materials Other Than Lumber: In accordance with standard under which product is produced.

2.1.5 Fire-Retardant Treatment

All exposed wood in storage room areas shall be fire-retardant treated wood and shall be pressure treated in accordance with AWPA C20 for lumber and AWPA C27 for plywood. Material use shall be defined in AWPA C20 and AWPA C27 for Interior Type A and B and Exterior Type. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material shall bear identification of the testing agency to indicate performance in accordance with such rating. Treated materials to be exposed to rain wetting shall be subjected to an accelerated weathering technique in accordance with ASTM D 2898 prior to being tested for compliance with AWPA C20 or AWPA C27. Items to be treated include: Exposed wood blocking and plywood panels in the equipment storage area.

2.1.6 *Omitted*

2.1.7 Sheathing

Sheathing shall be fiberboard, gypsum board, plywood, structural-use panels, or wood for wall sheathing; and plywood, structural-use panels, or wood for roof sheathing.

2.1.7.1 Fiberboard

Fiberboard shall conform to ASTM C 208, Type IV, Grade 2, Structural Grade, or AHA A194.1, Type IV, Grade 2 asphalt impregnated or asphalt coated to be water-resistant but vapor permeable.

2.1.7.2 Gypsum Board

Gypsum board shall conform to ASTM C 79, 12.7 mm thick (1/2 inch thick), 1200 mm (4 feet) wide with straight edges for supports 400 mm (16 inches) on center without corner bracing of framing or for supports 600 mm (24 inches) on center with corner bracing of framing; 600 mm wide (2 feet wide) with V-tongue and groove edges for supports 400 or 600 mm (16 or 24 inches) on center with corner bracing of framing.

2.1.7.3 Plywood

Plywood shall conform to DOC PS 1, Grade C-D with exterior glue. Sheathing for roof and walls without corner bracing of framing shall have a span rating of 16/0 or greater for supports 400 mm (16 inches) on center and a span rating of 24/0 or greater for supports 600 mm (24 inches) on center.

2.1.7.4 Structural-Use Panels

Panels shall meet the qualification requirements of APA E445 for rated sheathing, Exposure 1 or Structural I rated sheathing, Exposure 1. Sheathing for roofs or walls without corner bracing of framing shall have a span rating of 16/0 or greater for supports 400 mm (16 inches) on center and shall have a span rating of 24/0 or greater for supports 600 mm (24 inches) on center.

2.1.7.5 Wood

Species and grade shall be in accordance with TABLE I at the end of this section. Wall sheathing shall be 25 mm (1 inch) thick for supports 400 or 600 mm (16 or 24 inches) on center without corner bracing of framing provided sheathing is applied diagonally. Roof sheathing shall be 25 mm (1 inch) thick for supports 400 or 600 mm (16 or 24 inches) on center.

2.1.8 *Omitted*
2.1.9 *Omitted*
2.1.10 *Omitted*
2.1.11 *Omitted*
2.1.12 *Omitted*

2.1.12.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

| Member | Size mm (inch) |
|---|---|
| Bridging | 25 by 75 (1 by 3) or 25 by 100 (1 by 4) for use between members 50 by 300 (2 by 12) and smaller; 50 by 100 (2 by 4) for use between members larger than 50 by 300 (2 by 12). |
| Corner bracing | 25 by 100 (1 by 4). |
| Furring | 25 (1) by 50 (2) |
| Grounds | Plaster thickness by 38. |
| Nailing strips | 25 by 75 (1 by 3) or 25 by 100 (1 by 4) when used as shingle base or interior finish, otherwise 50 mm (2 inch) stock. |

| Member | Size (inch) |
|---|---|
| Bridging | 1 by 3 or 1 by 4 for use between members 2 by 12 and smaller; 2 by 4 for use between members larger than 2 by 12. |
| Corner bracing | 1 by 4. |

| | |
|---|---|
| Furring | 1 by 2. |
| Grounds | Plaster thickness by 1-1/2. |
| Nailing strips | 1 by 3 or 1 by 4 when used as shingle base or interior finish, otherwise 2 inch stock. |

2.1.12.2 Wood Bumpers

Bumpers shall be of the species and grade in accordance with TABLE II at the end of this section, size as shown.

2.1.12.3 Sill Plates

Sill plates shall be standard or number 2 grade.

2.1.12.4 Blocking

Blocking shall be standard or number 2 grade.

2.1.12.5 Rough Bucks and Frames

Rough bucks and frames shall be straight standard or number 2 grade.

2.2 ACCESSORIES AND NAILS

Markings shall identify both the strength grade and the manufacturer. Accessories and nails shall conform to the following:

2.2.1 Anchor Bolts

ASTM A 307, size as indicated, complete with nuts and washers.

2.2.2 Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws

Type, size, and finish best suited for intended use. Finish options include zinc compounds, cadmium, and aluminum paint impregnated finishes.

2.2.3 Clip Angles

Steel, 4.8 mm (3/16 inch) thick, size best suited for intended use; or zinc-coated steel or iron commercial clips designed for connecting wood members.

2.2.4 Expansion Shields

Type and size best suited for intended use.

2.2.5 Joist Hangers

Steel or iron, zinc-coated, size to fit members where used, sufficient strength to develop the full strength of supported member, complete with any special nails required.

2.2.6 Metal Bridging

Optional to wood bridging; zinc-coated steel, size and design to provide rigidity equivalent to specified wood bridging.

2.2.7 Nails and Staples

ASTM F 547, size and type best suited for purpose; staples shall be as recommended by the manufacturer of the materials to be joined. For sheathing and subflooring, length of nails shall be sufficient to extend 25 mm (1 inch) into supports. In general, 8-penny or larger nails shall be used for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2-inch) thick lumber; 16-penny or larger nails shall be used for nailing through 50 mm (2-inch) thick lumber. Nails used with treated lumber and sheathing shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AFPA T11-WCD1. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AFPA-T901. Reasonable judgement backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

2.2.8 Timber Connectors

Unless otherwise specified, timber connectors shall be in accordance with TPI 85 or AITC-01.

2.3 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown. R-values shall be determined at 24 degrees C (75 degrees F) in accordance with ASTM C 518. Insulation shall contain the highest practicable percentage of recovered material which has been recovered or diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

2.3.1 Batt or Blanket

2.3.1.1 Glass Fiber Batts and Rolls

Glass fiber batts and rolls shall conform to ASTM C 665, Type III foil faced insulation, Class A, having a UL rating of 25 and a smoke developed rating of 150 or less when tested in accordance with ASTM E 84. Insulation shall have a 0.25 mm (10 mil) thick, white, puncture resistant woven-glass cloth with vinyl facing on one side. Width and length shall suit construction conditions.

2.3.1.2 Mineral Fiber Batt

Mineral fiber batt shall conform to ASTM C 665, Type III foil faced insulation Class C.

2.3.1.3 Mineral Fiber Blanket

Mineral fiber blanket shall conform to ASTM C 553, Type I, Class 6. Blankets shall be sized to suit construction conditions, resilient type for use below and above ambient temperature to 195 degrees C (350 degrees F). Blankets shall have a factory applied vapor-barrier facing on one side with 50 mm (2-inch) nailing tabs on both edges. Vapor barriers shall be fire retardant, high vapor transmission, and aluminum foil laminated to crepe paper type conforming to ASTM C 1136, Type II. Nominal density shall be 12 kg per cubic meter (0.75 pcf).

2.3.2 Loose Fill or Granular Fill

2.3.2.1 Vermiculite

Vermiculite shall conform to ASTM C 516, Type II.

2.3.2.2 Perlite

Perlite shall conform to ASTM C 549, Type II with minimum recovered material content of 23 percent by weight of core material.

2.3.3 Sill Sealer

Mineral wool, 25 mm (1 inch) thick and compressible to 0.8 mm (1/32 inch), width of sill, designed to perform as an air, dirt, and insect seal in conformance with ASTM C 665, Type I.

2.3.4 Rigid Insulation

2.3.4.1 Polystyrene Board

Polystyrene board shall be extruded and conform to ASTM C 578, Type IV.

2.3.4.2 Polyurethane or Polyisocyanurate Board

Polyurethane or polyisocyanurate board shall conform to ASTM C 1013 (having a minimum recovered material content of 9 percent by weight of core material in the polyurethane or polyisocyanurate portion). Unfaced preformed polyurethane shall conform to ASTM C 591. Faced polyisocyanurate shall conform to ASTM C 1289.

2.3.4.3 Glass Fiber or Insulation Board

Glass fiber or insulation board shall conform to ASTM C 612, Type 1A.

2.3.4.4 Mineral Fiber Block and Board

Mineral fiber block and board shall conform to ASTM C 612 or ASTM C 726.

2.3.4.5 Cellular Glass

Cellular glass shall conform to ASTM C 552.

2.4 VAPOR RETARDER

Vapor retarder shall be polyethylene sheeting conforming to ASTM E 154 or other equivalent material. Vapor retarder shall have a maximum vapor permeance rating of 29 ng per Pa per second per square meter (0.5 perms) as determined in accordance with ASTM E 96, unless otherwise specified.

2.5 AIR INFILTRATION BARRIER

Air infiltration barrier shall be building paper meeting the requirements of ASTM C 1136, Type IV, style optional or a tear and puncture resistant olefin building wrap (polyethylene or polypropylene) with a moisture vapor transmission rate of 125 g per square meter per 24 hours 125 g per square meter per 24 hours) in accordance with ASTM E 96, Desiccant Method at 23 degrees C or with a moisture vapor transmission rate of 670 g per square meter per 24 hours 670 g per square meter per 24 hours) in accordance with ASTM E 96, Water Method at 23 degrees C.

PART 3 EXECUTION

3.1 INSTALLATION OF FRAMING

### 3.1.1 General

Members shall be closely fitted, accurately set to required lines and levels, and rigidly secured in place. Members shall be framed for passage of ducts. Members shall be cut, notched, or bored in accordance with applicable requirements of AFPA-T901 for the passage of pipes, wires, or conduits. Rafters, purlins, and joists shall be set with crown edge up. Framing shall be kept at least 50 mm (2 inches) away from chimneys and 100 mm (4 inches) away from fireplace backwalls. When joists, beams, and girders are placed on masonry or concrete, a wood base plate shall be positioned and leveled with grout. The joist, beam, or girder shall then be placed on the plate. When joists, beams, and girders are set into masonry or concrete, a pocket shall be formed into the wall. The joist, beam, or girder shall then be placed into the pocket and leveled with a steel shim.

### 3.1.2 Structural Members

Members shall be adequately braced before erection. Members shall be aligned and all connections completed before removal of bracing. Individually wrapped members shall be unwrapped only after adequate protection by a roof or other cover has been provided. Scratches and abrasions of factory-applied sealer shall be treated with two brush coats of the same sealer used at the factory.

### 3.1.3 Partition and Wall Framing

Unless otherwise shown, studs shall be spaced 600 mm (24 inches) on centers. Studs shall be doubled at openings. Unless otherwise indicated, headers for openings shall be made of two pieces of stud material set on edge or solid lumber of equivalent size, and corners shall be constructed of not less than three full members. End studs of partitions abutting concrete or masonry shall be anchored thereto with expansion bolts, one near each end of each stud and at intermediate intervals of not more than 1200 mm (4 feet). Plates of partitions resting on concrete floors shall be anchored in place with expansion bolts, one near each end of each piece and at intermediate intervals of not more than 1800 mm (6 feet) between bolts. In lieu of expansion bolts, anchoring into concrete may be accomplished with powder-driven threaded studs of suitable type and size and spaced at 900 mm (3 feet) on center. Walls and load bearing partitions shall be provided with double top plates with members lapped at least 600 mm (2 feet) and well spiked together.

### 3.1.4 Floor (Ceiling) Framing

Except where otherwise indicated joists shall have bearings not less than 100 mm (4 inches) on concrete or masonry and 38 mm (1-1/2 inches) on wood or metal. Joists, trimmers, headers, and beams framing into carrying members at the same relative levels shall be carried on joist hangers. Joists shall be lapped and spiked together at bearings or butted end-to-end with scab ties at joint and spiked to plates. Openings in floors shall be framed with headers and trimmers. Headers carrying more than two tail joists and trimmers supporting headers carrying more than one tail joist shall be doubled, unless otherwise indicated. Joists shall be doubled under partitions parallel with floor joists. Joists built into masonry shall be provided with a beveled fire cut so that the top of the joist does not enter the wall more than 25 mm (1 inch) or standard steel wall bearing boxes. Engineered wood joists shall be installed in accordance with distributor's instructions.

## 3.2 INSTALLATION OF SHEATHING

### 3.2.1 Fiberboard

Sheathing shall be applied with edges 3 mm (1/8 inch) apart at joints, fitted snugly at abutting frames of openings, and nailed or stapled in accordance

with the manufacturer's approved instructions. Sheets shall be applied vertically, extended over top and bottom plates, and with all vertical and horizontal joints over supports.

3.2.2 Gypsum Board

Sheathing shall be applied with edges in light contact at joints and nailed in accordance with the manufacturer's approved instructions. Sheets 600 mm (2 feet) wide shall be applied horizontally with tongued edge up, with vertical joints over supports, and with vertical joints staggered. Sheets 1200 mm (4 feet) wide shall be applied vertically, extended over top and bottom plates, and with all vertical and horizontal joints over supports.

3.2.3 Plywood and Structural-Use Panels

Sheathing shall be applied with edges 3 mm (1/8 inch) apart at side and end joints, and nailed at supported edges at 150 mm (6 inches) on center and at intermediate supports 300 mm (12 inches) on center. Nailing of edges shall be 10 mm (3/8 inch) from the edges. Wall sheathing shall extend over top and bottom plates, and if applied horizontally the vertical joints shall be made over supports and staggered. Wall sheathing over which wood shingles are to be applied shall be applied horizontally. Roof sheathing shall be applied with long dimension at right angles to supports, end joints made over supports, and end joints staggered.

3.2.4 Wood

Sheathing end joints shall be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board shall bear on at least three supports. Boards shall be nailed at each support using two nails for boards 150 mm (6 inches) and less in width and three nails for boards more than 150 mm (6 inches) in width. Roof sheathing shall not be installed where roof decking is installed.

3.3 *OMITTED*
3.4 *OMITTED*
3.5 *OMITTED*

3.6 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

3.6.1 Bridging

Wood bridging shall have ends accurately bevel-cut to afford firm contact and shall be nailed at each end with two nails. Metal bridging shall be installed as recommended by the manufacturer. The lower ends of bridging shall be driven up tight and secured after subflooring or roof sheathing has been laid and partition framing installed.

3.6.2 Corner Bracing

Corner bracing shall be installed when required by type of sheathing used or when siding, other than panel siding, is applied directly to studs. Corner bracing shall be let into the exterior surfaces of the studs at an angle of approximately 45 degrees, shall extend completely over wall plates, and shall be secured at each bearing with two nails.

3.6.3 Blocking

Blocking shall be provided as necessary for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide firestopping. Blocking for firestopping shall ensure a maximum dimension of

2.4 m (8 feet) for any concealed space. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

3.6.4 Nailers and Nailing Strips

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Nailers used in conjunction with roof deck installation shall be installed flush with the roof deck system. Stacked nailers shall be assembled with spikes or nails spaced not more than 450 mm (18 inches) on center and staggered. Beginning and ending nails shall not be more than 150 mm (6 inches) for nailer end. Ends of stacked nailers shall be offset approximately 300 mm (12 inches) in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members when necessary, and rigidly secured in place.

3.6.5 Wood Grounds

Wood grounds shall be provided as necessary for attachment of trim, finish, and other work to plaster. Grounds shall be run in lengths as long as practicable, butt jointed, and rigidly secured in place.

3.6.6 Furring Strips

Furring strips shall be provided at the locations shown. Furring strips shall be installed at 400 mm (16 inches) on center unless otherwise shown, run in lengths as long as practicable, butt jointed and rigidly secured in place.

3.6.7 Rough Bucks and Frames

Rough bucks shall be set straight, true, and plumb, and secured with anchors near top and bottom of each wood member and at intermediate intervals of not more than 900 mm. (3 feet.) Anchors for concrete shall be expansion bolts, and anchors for masonry shall be 5 by 32 mm (3/16 by 1-1/4 inch) steel straps extending not less than 200 mm (8 inches) into the masonry and turned down 50 mm (2 inches) into the masonry.

3.6.8 Wood Bumpers

Wood bumpers shall be bored, countersunk and securely bolted in place.

3.6.9 Sill Plates

Sill plates shall be set level and square and anchor bolted at not more than 1800 mm (6 feet) on centers and not more than 300 mm (12 inches) from end of each piece. A minimum of two anchors shall be used for each piece.

3.7 *OMITTED*

3.8 INSTALLATION OF INSULATION

Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the thermal resistance (R-values) shown. For acoustical insulation the installed thickness shall be as shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

3.9 INSTALLATION OF VAPOR RETARDER

Vapor retarder shall be applied to provide a continuous barrier at window and door frames, and at all penetrations such as electrical outlets and switches, plumbing connections, and utility service penetrations. Joints in the vapor retarder shall be lapped and sealed according to the manufacturer's recommendations.

3.10 INSTALLATION OF AIR INFILTRATION BARRIER

Air infiltration barrier shall be installed in accordance with the manufacturer's recommendations.

TABLE I. SPECIES AND GRADE

Subflooring, Roof Sheathing, Wall Sheathing, Furring

| Grading Rules | Species | Const Standard | No. 2 Comm | No. 2 Board Comm | No. 3 Comm |
|---|---|---|---|---|---|
| NHLA-01 | Cypress | | | X | |
| NELMA-01 | Northern White Cedar | | | | X |
| | Eastern White Pine | X | | | |
| | Northern Pine | X | | | |
| | Balsam Fir | | | | X |
| | Eastern Hemlock-Tamarack | | | | X |
| CRA-RIS-01-SS | Redwood | | X | | |
| SCMA-01 | Cypress | | | X | |
| SPIB-1001 | Southern Pine | | X | | |
| WCLIB Std 17 | Douglas Fir-Larch | X | | | |
| | Hem-Fir | X | | | |
| | Sitka Spruce | X | | | |
| | Mountain Hemlock | X | | | |
| | Western Cedar | X | | | |
| WWPA-01 | Douglas Fir-Larch | X | | | |
| | Hem-Fir | X | | | |
| | Idaho White Pine | X | | | |
| | Lodgepole Pine | | | X | |
| | Ponderosa Pine | | | X | |
| | Sugar Pine | | | X | |
| | Englemann Spruce | | | X | |
| | Douglas Fir South | | | X | |
| | Mountain Hemlock | | | X | |
| | Subalpine Fir | | | X | |
| | Western Cedar | | | X | |

TABLE II. SPECIES AND GRADE

Wood Bumpers

| Grading Rules | Species | No. 1 | No. 2 |
|---|---|---|---|
| NHLA-01 | Red Oak | X | |
| NELMA-01 | Northern Pine | | X |
| | Eastern Hemlock-Tamarack | | X |
| SPIB-1001 | Southern Pine | X | |
| WCLIB Std 17 | Douglas Fir-Larch | | X |
| | Hem-Fir | | X |
| WWPA-01 | Douglas Fir-Larch | | X |
| | Hem-Fir | | X |
| | Douglas Fir-South | | X |

-- End of Section --

SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.6 (1990) Hardboard Siding

AMERICAN PLYWOOD ASSOCIATION (APA)

APA E445 (1991; Rev May 1991) Performance Standards and Policies for Structural-Use Panels

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1435 (1994) Outdoor Weathering of Plastics

ASTM D 2898 (1994) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing

ASTM D 3679 (1993) Rigid Poly(Vinyl Chloride) (PVC) Siding

ASTM F 547 (1977; R 1990) Definitions of Terms Relating to Nails for Use with Wood and Wood-Base Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C9 (1993) Plywood - Preservative Treatment by Pressure Processes

AWPA C20 (1993) Structural Lumber - Fire-Retardant Treatment by Pressure Processes

AWPA C27 (1993) Plywood - Fire-Retardant Treatment by Pressure Processes

AWPA M4 (1991) The Care of Preservative-Treated Wood Products

AWPA P5 (1993) Standards for Waterborne Preservatives

ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI-02 (1994) Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA-RIS-01-SS (1995) Standard Specifications for Grades of California Redwood Lumber

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1983) Construction and Industrial Plywood

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA-01 (1993) Standard Grading Rules for Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURER'S ASSOCIATION (SCMA)

SCMA-01 (1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB-1001 (1994) Standard Grading Rules for Southern Pine Lumber

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1993) Grading Rules For West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01 (1991; Supple No. 3) Western Lumber Grading Rules 91

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)

WMMPA WM 6 (1987) Industry Standard for Non-Pressure Treating of Wood Millwork

1.2 SUBMITTALS

Government approval is required for submittals with a "FIO" 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

Finish Carpentry; FIO.

Drawings showing fabricated items and special mill and woodwork items. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

SD-14 Samples

Siding; FIO. Moldings; FIO. Fascias and Trim; FIO.

Samples shall be of sufficient size to show patterns, color ranges, and types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 WOOD ITEMS, SIDING, AND TRIM

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 Sizes and Patterns

Lumber sizes and patterns shall conform to rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Sizes and patterns for materials other than lumber shall conform to requirements of the rules or standards under which produced. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Moisture Content

The maximum moisture content of untreated trim and wood siding shall be 15 percent at the time of delivery to the jobsite and when installed. Moisture content of all other material shall be in accordance with the standard under which the product is produced.

2.1.4 Preservative Treatment

2.1.4.1 Plywood

Plywood shall be treated in accordance with AWPA C9 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

a. 4 kg per cubic meter (0.25 pcf) intended for above ground use.

b. 6.4 kg per cubic meter (0.4 pcf) intended for ground contact and fresh water use.

2.1.4.2 Exterior Wood Molding and Millwork

Exterior wood molding and millwork within 455 mm (18 inches) of soil, in contact with water or concrete shall be preservative-treated in accordance with WMMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil.

2.1.5 *Omitted*
2.1.6 *Omitted*
2.1.7 *Omitted*
2.1.8 *Omitted*

2.1.9 Fascias and Trim

2.1.9.1 Wood

Fascias and trim, including exterior door and window casing, shall be species and grade listed in TABLE I at the end of this section. Sizes shall be as indicated. Metal corners may be furnished in lieu of wood cornerboards for horizontal siding; and if furnished, shall be galvanized steel and primed or aluminum and primed.

2.1.10 *Omitted*
2.1.11 *Omitted*

2.1.12 Woodwork Items

2.1.12.1 Bulletin Boards

Bulletin boards shall have a hardwood or aluminum frame, 6.4 mm (1/4 inch) thick plywood or hardboard back; and a 6.4 mm (1/4 inch) thick, dense, smooth faced corkboard face securely cemented to the back.

2.1.12.2 Dry Markerboards

Markerboards shall have a hardwood or aluminum frame and 6.4 mm (1/4 inch) thick writing surface of cast acrylic plastic plate glass with color fused to surface or porcelain enamel laminated to plywood. Color shall be white.

2.1.12.3 Utility Shelving

Utility shelving shall be a suitable species equal to or exceeding requirements of No. 3 Common white fir under WWPA-01, 25 mm (1 inch) thick; or plywood, interior type, Grade A-B, 12.7 mm (1/2 inch) thick, any species group.

2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 40 mm (1-1/2 inches) into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

PART 3 EXECUTION

3.1 *OMITTED*
3.2 *OMITTED*

3.3 FASCIAS AND EXTERIOR TRIM

Exposed surfaces and square edges shall be machine sanded, caulked, and constructed to exclude water. Joints of built-up items, in addition to nailing, shall be glued as necessary for weather-resistant construction. End joints in built-up members shall be well distributed. Joints in flat work shall be shouldered. Backs of wide-faced miters shall be held together with metal rings and glue. Fascias and other flat members shall be in maximum practicable lengths. Cornices shall be braced, blocked, and rigidly anchored for support and protection of vertical joints.

3.4 MOLDING AND INTERIOR TRIM

Molding and interior trim shall be installed straight, plumb, level and with closely fitted joints. Exposed surfaces shall be machine sanded at the mill. Molded work shall be coped at returns and interior angles and mitered at external corners. Intersections of flatwork shall be shouldered to ease any inherent changes in plane. Window and door trim shall be provided in single

lengths. Blind nailing shall be used to the extent practicable, and face nailing shall be set and stopped with a nonstaining putty to match the finish applied. Screws shall be used for attachment to metal; setting and stopping of screws shall be of the same quality as required where nails are used.

3.5 *OMITTED*
3.6 *OMITTED*

3.7 WOODWORK ITEMS

3.7.1 Bulletin Boards and Markerboards

Items shall be installed in accordance with the manufacturer's recommendation.

3.7.2 Shelving

Shelving shall be anchored to supporting construction. Unless otherwise indicated, shelves shall be supported by wall-supported brackets not more than 600 mm (24 inches) on center or as required to limit deflection to 6 mm (1/4 inch) between supports with a load of 525 N per meter (35 lb per lineal foot). Adjustable shelf hardware shall be steel standards, channel shaped, with 25 mm (1 inch) adjustment slots and brackets designed for attachment to standards.

3.7.3 Clothes Hanger Rods

Rods shall be provided where indicated and in all closets having hook strips. Rods shall be aluminum pipe or tubing 25.4 mm (1 inch) in diameter. Rods shall be set parallel with the front edges of the shelving, and shall be supported at each end by suitable sockets, and by intermediate brackets spaced at not more than 1200 mm (4-foot) centers.

-- End of Section --

SECTION 07160

BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 41 (1985) Asphalt Primer Used in Roofing, Dampproofing and Waterproofing

ASTM D 1187 (1982) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

ASTM D 1227 (1987) Emulsified Asphalt Used as a Protective Coating for Roofing

ASTM D 4479 (1993) Asphalt Roof Coatings - Asbestos Free

1.2 SUBMITTALS

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

SD-13 Certificates

Materials; Exterior Masonry dampproofing on CMU for brick back-up; FIO.

Certificates attesting that the materials meet the requirements specified, FIO.

1.3 QUALIFICATIONS

Work shall be performed by skilled laborers thoroughly experienced in the type of bituminous dampproofing work specified to meet the requirements of the contract.

1.4 DELIVERY, STORAGE AND HANDLING

Dampproofing materials shall be delivered to the project site in the original sealed containers bearing the name of manufacturer, contents and brand name, and stored in a weathertight enclosure to prevent moisture damage and absorption. Dampproofing materials shall be protected from freezing. Asphalt shall be stored off the ground on pallets, and covered on top and all sides with breathable-type canvas tarpaulins. Plastic sheets cause condensation buildup and therefore shall not be used to cover dampproofing materials. Care shall be taken during storage to avoid separation or settlement of the emulsion components. Damaged or deteriorated materials shall be removed from the project site.

## PART 2 PRODUCTS

### 2.1 EMULSION-BASED ASPHALT DAMPPROOFING

#### 2.1.1 Fibrated Emulsion-Based Asphalt

Fibrated emulsion-based asphalt dampproofing shall be cold-applied type conforming to ASTM D 1227 Type IV, asbestos-free, manufactured of refined asphalt, emulsifiers and selected clay, fibrated with mineral fibers. For spray or brush application, emulsion shall contain a minimum of 59 percent solids by weight, 56 percent solids by volume. For trowel application, emulsion shall contain a minimum of 58 percent solids by weight, 55 percent solids by volume.

### 2.2 SOLVENT-BASED ASPHALT DAMPPROOFING

#### 2.2.1 Asphaltic Primer

Primer for cold-applied solvent-based asphalt dampproofing shall conform to ASTM D 41, asbestos-free, nonfibrated, manufactured with highly ductile soft asphalts and selected hydrocarbons.

#### 2.2.2 Fibrated Asphalt

Fibrated solvent-based asphalt dampproofing shall be cold-applied type conforming to ASTM D 4479 Type I, asbestos-free, manufactured with selected asphalts, stabilizers, mineral spirits and fibrated with mineral fibers. Solvent-based asphalt shall contain 72 percent solids by weight, 65 percent solids by volume.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Surfaces scheduled for bituminous dampproofing shall be prepared in accordance with dampproofing manufacturer's recommendations. Surface preparation shall be approved prior to dampproofing application.

#### 3.1.1 Protection of Surrounding Areas

Before starting the dampproofing work, the surrounding areas and surfaces shall be protected from spillage and migration of asphalt onto other work. Drains and conductors shall be protected from clogging with asphalt.

#### 3.1.2 Masonry Surfaces

Surfaces shall be free of oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Mortar joints shall be flush and free of extraneous mortar and chipped or broken masonry.

#### 3.1.3 Concrete Surfaces

Surfaces shall be properly cured, free of form release agents, oil, grease, dirt, laitance, loose material, frost, debris and other contaminants. Form ties shall be cut flush with surface. Sharp protrusions and form match lines shall be removed. Holes, voids, spalled areas and cracks which can damage the dampproofing materials and impair performance shall be repaired. Rough surfaces shall be parged with a well-adhering coat of cement mortar.

3.1.4 Metal Surfaces

Metal surfaces shall be dry and be free of rust, scale, loose paint, oil, grease, dirt, frost and debris.

3.2 APPLICATION OF BITUMINOUS DAMPPROOFING

3.2 Emulsion-Based Asphalt

Emulsion-based asphalt dampproofing work shall not be performed in temperatures below 4 degrees C (40 degrees F). Emulsions shall have a smooth and uniform consistency at time of application. Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film of not less than 0.3 mm (12 mils) thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

a. Primer: 0.2 liter per square meter (1/2 gallon per 100 square feet), cold-applied.

b. Fibrated Dampproofing: 0.8 liter per square meter (2 gallons per 100 square feet), cold-applied with spray, brush or trowel.

c. Nonfibrated Dampproofing: 0.8 liter per square meter (2 gallons per 100 square feet), cold-applied with spray, brush or trowel.

3.2.2 Solvent-Based Asphalt

Solvent-based asphalt dampproofing work shall not be performed in temperatures below 4 degrees C (40 degrees F). Dampproofing materials shall be applied in accordance with manufacturer's published instructions to produce a smooth uniform dry film not less than 0.3 mm (12 mils) thick without voids or defects. Dull or porous spots shall be recoated. Dampproofing materials shall seal tightly around pipes and other items projecting through dampproofing. Rates of application shall be as follows:

a. Primer: 0.4 liter per square meter (1/2 gallon per 200 square feet), cold-applied.

b. Dampproofing Coat: 0.8 liter per square meter (2 gallons per 100 square feet), cold-applied with spray, brush or trowel.

3.3 CLEANUP

Surfaces of other work which are stained with dampproofing materials shall be cleaned with a cleaner recommended by dampproofing manufacturer.

3.4 PROTECTION

The completed dampproofing work shall be protected from damage during and after construction.

-- End of Section --

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 208 (1995) Cellulosic Fiber Insulating Board

ASTM C 552 (1991) Cellular Glass Thermal Insulation

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal Insulation

ASTM C 726 (1993) Mineral Fiber Roof Insulation Board

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 226 (1994) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

ASTM D 312 (1995) Asphalt Used in Roofing

ASTM D 2178 (1989) Asphalt Glass Felt Used in Roofing and Waterproofing

ASTM D 4586 (1993) Asphalt Roof Cement, Asbestos Free

ASTM D 4897 (1994) Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing

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

UNDERWRITERS LABORATORIES (UL)

UL-01 (1996) Building Materials Directory

1.2 SUBMITTALS

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

SD-06 Instructions FIO

Application of Insulation; for roofs above structural metal decks and covered with metal roof panels.

Insulation manufacturer's recommendations for the application and installation of insulation.

SD-08 Statements FIO

Inspection; of structural deck prior to insulation installation and after completion of operation.

The inspection procedure for insulation installation, prior to start of roof insulation work.

SD-13 Certificates FIO

Insulation; isocyanurate roof insulation. Glass Roofing Felt; Type VI varpor barrier.

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 (50 degrees F) for 24 hours immediately before laying.

1.4 FIRE CLASSIFICATION

Insulation shall have been tested as part of a roof construction assembly of the type used in this project and the construction shall be listed as Fire-Classified in UL-01 or Class I in FM P7825, except for installation on poured concrete decks.

PART 2 PRODUCTS

2.1 OMITTED

2.2 INSULATION

Insulation shall be a standard product of the manufacturer and shall be factory marked with the manufacturer's name or trade mark, the material specification number, the R-value at 24 degrees C (75 degrees F), and the thickness. Minimum thickness shall be as recommended by the manufacturer.

Boards shall be marked individually. The thermal resistance of insulation shall be not less than the R-value shown on the drawings. The 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, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one having the higher recovered material content shall be selected. Insulation shall be one, or a combination of the following materials:

2.3 NAILS AND FASTENERS

Nails and fasteners shall conform to the following requirements:

2.3.1 Nails for Fastening Insulation to Flush Mounted 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 534 N (120 pounds) each in steel deck. Fasteners for steel decks shall conform to FM P7825 for Class I roof deck construction, and shall be spaced to withstand an uplift pressure of 2.87 kPa 50 pounds per square foot).

2.3.3 Metal Disks

Flat and not less than 0.39 mm (30 gauge) thickness. Disks used with nails or fasteners for securing fiberboard insulation shall be minimum 25 mm (1 inch) diameter. Disks used with nails or fasteners for securing other board insulation shall be minimum 53 mm (2-1/8 inches) in diameter.

2.4 OMITTED

2.5 GLASS ROOFING FELT

ASTM D 2178, Type IV.

2.6 OMITTED

2.7 WOOD NAILERS

Wood nailers shall conform to Section 06100 ROUGH CARPENTRY including preservative treatment. Edge nailers shall be not less than nominal 150 mm (6 inches) wide and of thickness to finish flush with the top surface of the insulation. Surface mounted nailers shall be a nominal 75 mm (3 inches) 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 1 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 (40 degrees F) and there shall be no visible ice, frost, or moisture on the roof deck when the insulation and

roofing are installed.

## 3.3 SUBSTRATE PREPARATION

The substrate construction of any bay or section of the building shall be completed before insulation or vapor retarder work is begun thereon. Vents and other items penetrating the roof shall be secured in position and properly prepared for flashing. Prior to application of vapor retarder or insulation, substrate joints shall be covered with a 100 mm (4-inch) strip of roofing felt, embedded in and coated with asphalt cement. Substrate surface shall be smooth, clean, and dry at time of application.

## 3.4 HEATING OF ASPHALT

Asphalt shall not be heated higher than 42 degrees C (75 degrees F) above the EVT or 28 degrees C (50 degrees F) below the flash point, or 275 degrees C (525 degrees F), whichever is lower. EVT and flash point temperatures of asphalt in the kettle shall be conspicuously posted on the kettle. Kettle shall be provided with automatic thermostatic controls and an accurate thermometer. Kettle operators shall be in attendance at all times during heating to ensure that the maximum temperature is not exceeded. Asphalt shall be applied within a range of 14 degrees C (25 degrees F) below or above the EVT, or as specified by the manufacturer. Application temperature shall be measured at the mop bucket or mechanical applicator. Asphalt at a temperature below this range shall be returned to the kettle. Flame-heated equipment shall not be placed on the roof.

## 3.5 VAPOR RETARDER

### 3.5.1 General Application

Vapor retarder shall consist of two plies of roofing felt, mechanically anchored and mopped at right angle to the slope, with 150 mm (6-inch) end laps staggered at least 300 mm (12 inches). The full 475 mm (19-inch) starter ply and full 900 mm (36-inch) wide ply sheets shall be placed, in succession, in hot asphalt immediately behind the applicator. Each ply shall be solid mopped in not less than 0.50 (10) nor more than .75 kg (15 pounds) of asphalt per square meter (square). A squeegee shall be used with glass felts and a broom shall be used with organic felts to embed the felts, eliminate air pockets and obtain adhesion between the plies. Side and end laps shall be completely sealed. Asphalt shall be visible beyond all edges of each ply as it is being installed. Plies shall be laid free of wrinkles, creases or fishmouths. Workers shall not walk on mopped surfaces when the asphalt is sticky. For slopes exceeding 42 mm/m (1/2 inch per foot), each ply shall be nailed 50 mm and 150 mm (2 and 6 inches) from the upper edge with nails spaced 300 mm (12 inches) on centers and staggered in each row.

## 3.6 INSTALLATION OF WOOD NAILERS

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 (4 feet) face-to-face, except that where the insulation units are less than 1.2 meters (4 feet) in length the nailers shall be spaced to minimize cutting of the insulation.

## 3.7 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 (1/4 inch). Joints in successive layers shall be staggered with respect to joints of preceding layer. Where insulation is applied over steel deck, long edge joints shall continuously bear on surfaces of the steel deck. Insulation which can be readily lifted after installation is not considered to be adequately secured. Insulation shall be applied so that all roof insulation applied each day is waterproofed the same day. Phased construction will not be permitted.

3.7.1 Mechanical Fastening

On steel decks, or any slope exceeding 42 mm/m (1/2 inch per foot), 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.

3.7.2 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 isocyanurate.

3.7.3 Foam Insulation

Polyisocyanurate, foam insulations shall be isolated from built-up roof membrane by a separate or composite layer of cellular glass, mineral fiber board, perlite board, or fiberboard.

3.7.4 Installation

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 0.50 kg per meter (10 lbs per square). 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 (1/2 inch per foot), roof insulation shall be held in place by both asphalt mopping and mechanical fasteners. The edges of insulation boards adjoining vented nailers shall be kept free of asphalt.

3.7.5 Protection Requirements

The insulation shall be kept dry at all times. Insulation boards shall not be kicked into position. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent. Cutoffs shall be two layers of bituminous-saturated felt set in plastic bituminous cement. Cutoffs shall be removed when work is resumed. Edges of insulation at open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, shall be protected until permanent roofing and flashing is applied. Storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces will not be permitted. Smooth, clean board or plank walkways, runways, and platforms shall be used, as necessary to distribute weight to conform to indicated live load limits of roof construction a .86 kg/m (18 pounds per square foot) live load limit.

3.8 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.

b. Verification of certification, listing or label compliance with FM P7825.

c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.

d. Inspection of vapor retarder application, including edge envelopes and mechanical fastening.

e. Inspection of mechanical fasteners; type, number, length, and spacing.

f. Coordination with other materials, cants, sleepers, and nailing strips.

g. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.

h. Installation of cutoffs and proper joining of work on subsequent days.

i. Continuation of complete roofing system installation to cover insulation installed same day.

-- End of Section --

SECTION 07270

FIRESTOPPING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

ASTM E 814 (1994b) Fire Tests of Through-Penetration Fire Stops

UNDERWRITERS LABORATORIES (UL)

UL-05 (1995; Supple) Fire Resistance Directory

UL 723 (1993; Rev Apr 1994) Test for Surface Burning Characteristics of Building Materials

UL 1479 (1994) Fire Tests of Through-Penetration Firestops

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

Firestopping Materials; GA.

Detail drawings including manufacturer's descriptive data, typical details, installation instructions and the fire-test data and/or report as appropriate for the fire resistance rated construction and location. Submittal shall indicate the firestopping material to be provided for each type of application. When more than five penetrations are to receive firestopping, drawings shall indicate location and type of application.

SD-13 Certificates

Firestopping Materials; GA.

Certificates attesting that firestopping material complies with the specified requirements. The label or listing of the Underwriters Laboratories will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing agency equipped to perform such services, stating that the items have been tested and conform to the specified requirements and testing methods.

Installer Qualifications; FIO.

Certification stating that  installer is qualified and trained to install the specified firestopping material.

Inspection; FIO.

Manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.3 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing a material or a combination of materials to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

1.4 STORAGE AND DELIVERY

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to elements. Damaged or deteriorated materials shall be removed from the site.

1.5 INSTALLER QUALIFICATIONS

Installer of firestopping material shall be trained by the manufacturer or the manufacturer's representative, and shall have a minimum of 3 years experience in the installation of firestopping of the type specified.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured products complying with the following minimum requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL-05.

2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application.

2.1.3 Fire Resistance Rating

Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479, except that T Ratings are not required for penetrations smaller than or equal to a 100 mm (4-inch) nominal pipe or

0.01 square meter (16 square inches) in overall cross sectional area. Fire resistance ratings shall be the following:

a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = one hour, T Rating = one hour.

b. Penetrations of Fire Resistance Rated Floors and Ceiling-Floor Assemblies; F Rating = one hour, T Rating = one hour.

2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system.

3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping for filling floor voids 100 mm (4 inches) or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Firestopping shall be provided in the following locations, except in floor slabs on grade:

a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.

b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.

c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.

d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.

e. Construction joints in floors and fire rated walls and partitions.

f. Other locations where required to maintain fire resistance rating of the construction.

-- End of Section --

SECTION 07413

METAL ROOFING AND SIDING

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

AA-01 (1993) Aluminum Standards and Data

AA SAS-30 (1986) Aluminum Construction Manual Series - Section 1 Specifications for Aluminum Structures

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-673 (1987) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 446 (1993) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

ASTM A 463 (1994) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A 792 (1993a) 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 (1993) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM C 518 (1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

ASTM C 553 (1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

ASTM C 612 (1993) Mineral Fiber Block and Board Thermal Insulation

ASTM C 1289 (1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

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

ASTM D 523 (1989; R 1993) Specular Gloss

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

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

ASTM D 1308 (1987; R 1993) Effect of Household Chemicals on Clear and Pigmented Organic Finishes

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

ASTM D 2244 (1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates

ASTM D 2247 (1994) Testing Water Resistance of Coatings in 100% Relative Humidity

ASTM D 2794 (1993) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

ASTM D 3359 (1995) Measuring Adhesion by Tape Test

ASTM D 4214 (1989) Evaluating the Degree of Chalking of Exterior Paint Films

ASTM D 4397 (1991) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

ASTM E 84 (1994a) Surface Burning Characteristics of Building Materials

ASTM E 96 (1994) Water Vapor Transmission of Materials

ASTM E 1042 (1992) Acoustically Absorptive Materials Applied by Trowel or Spray

ASTM G 23 (1995) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

UNDERWRITERS LABORATORIES (UL)

UL 580 (1994; Rev thru Apr 1995) Tests for Uplift Resistance of Roof Assemblies

1.2 DESIGN REQUIREMENTS

*5 Since there is a wide variety in covering configuration, fastening systems, and accessories, excessive detailing of the covering system will be avoided. The moment of inertia and minimum section modulus of the ~~roof and~~ wall panels ~~and the roof slope~~ will be indicated 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-04 Drawings

*5 ~~Metal Roofing,~~ Fascia and Soffit and Siding; GA.

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

SD-13 Certificates

*5 ~~Roof Panels; GA.~~ Installation; FIO. Accessories; FIO.

*5 Certificates attesting that the panels and accessories conform to the requirements specified. Certificate for the ~~roof~~ wall 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 a representative sample consisting of not less than five pieces has been tested and has met the quality standards specified for factory color finish.

*5 Mill certification for structural bolts, and wall ~~and roof~~ covering, and wall liner panels.

Insulation; GA.

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

SD-14 Samples

Accessories; GA.

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

*5 ~~Roof Panels; GA.~~

*5 ~~One piece of each type and finish (exterior and interior) to be used, 225 mm (9 inches) long, full width.~~

Fasteners; FIO.

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

Insulation; GA.

One piece of each type to be used, and descriptive data covering installation.

Gaskets and Insulating Compounds; FIO.

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

Sealant; GA.

One sample, approximately 0.5 kg (1 pound), and descriptive data.

1.4 DELIVERY AND STORAGE

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

PART 2 PRODUCTS

2.1 ROOF COVERING

*5 ~~Panels shall be either steel or aluminum and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope when length of run is 9 m (30 feet) or less. When length of run exceeds 9 m (30 feet), each sheet in the run shall extend over two or more spans. Sheets longer than 9 m (30 feet) may be furnished if approved by the Contracting Officer. Width of sheets with overlapping configurations shall provide not less than 460 mm (18 inches) 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 except that gable end wall sheets may be cut in the shop to correspond to the roof slope and may have a horizontal joint at the eave line.~~ DELETED

2.1.1 *Omitted*

2.1.2 *Omitted*

2.1.3 Steel Panels

Zinc-coated steel conforming to ASTM A 446, G 90 coating designation; 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. ~~Roof and~~ Wall panels and trim shall be 0.6 mm (0.024 inch) thick minimum.

2.1.4 Aluminum Panels

Alloy conforming to ASTM B 209, temper as required for the forming operation, minimum 0.8 mm (0.032 inch) thick.

2.2 FACTORY COLOR FINISH

*5 Wall ~~and roof~~ 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 in Section 09915 COLOR SCHEDULE. The exterior coating shall be a nominal 0.025 mm (1 mil) thickness consisting of a polyvinylidene fluoride topcoat of not less than 0.018 mm (0.7 mil) dry film thickness and the paint manufacturer's recommended primer of not less than 0.005 mm (0.2 mil) thickness. The interior color finish shall consist of a backer coat with a dry film thickness of 0.013 mm (0.5 mil) thick prime coat. The exterior color finish shall meet the test requirements specified below.

2.2.1 Salt Spray Test

A sample of the sheets shall withstand a salt spray test for a minimum of 1,000 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 (1/8 inch) failure at scribe, as determined by ASTM D 1654.

2.2.2 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.

2.2.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested for a minimum of 1,000 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.

2.2.4 Humidity Test

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

2.2.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 equal to 1.5 times metal thickness in millimeters (mils) expressed in newton-meters (inch-pounds), with no loss of adhesion.

2.2.6 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.

2.2.7 *Omitted*

2.2.8 Pollution Resistance

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

2.3 ACCESSORIES

Accessories shall be compatible with the covering furnished. Soffits, fascia, rain gutters, 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.

2.4 FASTENERS

***5** Fasteners for steel ~~roof~~ wall panels or miscellaneous metal trim panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped
*5 steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum ~~roof~~ wall panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear strength of not less than 3.336 kN (750 lbs) per fastener. 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; have a minimum diameter of 9 mm (3/8 inch) for structural connections; and gasketed portion of

fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 3 mm (1/8 inch) thick. When wall covering is factory color finished, exposed wall fasteners shall be color finished or provided with plastic color caps to match the covering. Nonpenetrating fastener system for wall panels using concealed clips shall be manufacturer's standard for the system provided.

2.4.1 Screws

Screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

2.4.2 End-Welded Studs

Automatic end-welded studs shall be shouldered type with a shank diameter of not less than 5 mm (3/16 inch) and cap or nut for holding covering against the shoulder.

2.4.3 Explosive Actuated Fasteners

Fasteners for use with explosive actuated tools shall have a shank of not less than 3.68 mm (0.145 inch) with a shank length of not less than 13 mm (1/2 inch) for fastening panels to steel and not less than 25 mm (1 inch) for fastening panels to concrete.

2.4.4 Blind Rivets

Blind rivets shall be aluminum with 5 mm (3/16 inch) nominal diameter shank or stainless steel with 3 mm (1/8 inch) nominal diameter shank. Rivets shall be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems shall have closed ends.

2.4.5 Bolts

Bolts shall be not less than 6 mm (1/4 inch) diameter, shouldered or plain shank as required, with proper nuts.

2.5 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 24 degrees C (75 degrees F) in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory-marked or identified with manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Rigid insulation shall have a facing as specified in paragraph VAPOR RETARDER. Insulation, including facings, shall have a flame spread not in excess of 75 and a smoke developed rating not in excess 150 when tested in accordance with ASTM E 84. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory.

*5 2.5.1 Rigid Board Insulation for Use Above a Roof Deck or behind a wall panel.

2.5.1.1 Polyurethane or Polyisocyanurate

Polyurethane or polyisocyanurate insulation shall conform to ASTM C 1289, Type I, Class 2 (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For impermeable faced

polyisocyanurate (Ex: aluminum foil) the maximum design R-value per 25 mm (1 inch) of insulation used shall be 1.27 (7.2). Insulation shall be installed in two layers with staggered joints.

2.5.1.2 Mineral Fiber

Insulation shall conform to ASTM C 612.

2.5.2 Blanket Insulation

Blanket insulation shall conform to ASTM C 553.

2.6 INSULATION RETAINERS

Insulation retainers shall be type, size, and design necessary to adequately hold the insulation and to provide a neat appearance. Metallic retaining members shall be nonferrous or have a nonferrous coating. Nonmetallic retaining members, including adhesives used in conjunction with mechanical retainers or at insulation seams, shall have a fire resistance classification not less than that permitted for the insulation.

2.7 *OMITTED*

2.8 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. Concealed sealant may be the nonhardening type.

2.9 GASKETS AND INSULATING COMPOUNDS

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

2.10 VAPOR RETARDER

2.10.1 Vapor Retarders as Integral Facing

Insulation facing shall have a permeability of 5.7 ng per Pa-second-square meter 0.1 perm or less when tested in accordance with ASTM E 96. Facing shall be gray. Facings and finishes shall be factory applied.

2.10.2 Vapor Retarders Separate from Insulation

Vapor retarder material shall be polyethylene sheeting conforming to the requirements of ASTM D 4397. A single ply of 0.25 mm (10 mil) polyethylene sheet; or, at the option of the Contractor, a double ply of 0.15 mm (6 mil) polyethylene sheet shall be used. A fully compatible polyethylene tape shall be provided which has equal or better water vapor control characteristics than the vapor retarder material. A cloth industrial duct tape in a utility grade shall also be provided to use as needed to protect the vapor retarder from puncturing.

2.10.3 Slip Sheet for Use With Vapor Retarder

Slip sheet for use with vapor retarder shall be a 0.24 kg per square meter (5 per 100 square foot) rosin-sized, unsaturated building paper.

PART 3 EXECUTION

## 3.1 INSTALLATION

Installation shall be as specified and in accordance with the approved erection instructions and drawings to produce a weather tight structure. Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, 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.

*5 ### 3.1.1 ~~Roof~~ Wall Covering

*5 Wall covering shall be applied with the longitudinal configurations in the vertical position. ~~Roof~~ Wall covering shall be applied with the longitudinal configurations in the direction of the roof slope. Accessories shall be fastened into framing members, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction.

#### 3.1.1.1 Lap Type Panels with Exposed Fasteners

End laps shall be made over framing members with fasteners into framing members approximately 50 mm (2 inches) from the end of the overlapping sheet. 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 insofar as the maximum spacings specified are not exceeded and provided such standard practice will result in a structure which will be free from water leaks and meet design requirements. Spacing of fasteners shall present an orderly appearance and shall not exceed: 200 mm (8 inches) on center at end laps of covering, 200 mm (8 inches) on center at connection of covering to intermediate supports, *5 ~~300 mm (12 inches) on center at side laps of roof coverings~~, and 450 mm (18 inches) on center at side laps of wall coverings except when otherwise approved. Side laps and end laps of roof and wall covering and joints at accessories shall be sealed. Fasteners shall be installed in straight lines within a tolerance on 13 mm (1/2 inch) in the length of a bay. Fasteners shall be driven normal to the surface and to a uniform depth to seat the gasketed washers properly.

### 3.1.2 Insulation Installation

Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

#### 3.1.2.1 Board Insulation with Blanket Insulation

Rigid or semirigid board insulation shall be laid in close contact. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. A layer of blanket insulation shall be placed over the rigid or semirigid board insulation to be compressed against the underside of the metal roofing to reduce thermal bridging, dampen noise, and prevent roofing flutter. This layer of blanket insulation shall be compressed a minimum of 50 percent.

*5 ### 3.1.3 Protection of Vapor Retarder from Roof Deck or Framing

A cloth industrial duct tape shall be adhered over all the seams of metal roof decking, at any penetrations edges, and at all surface areas exhibiting sharp *5 burrs or similar protrusions. For other types of ~~roof decking~~ metal panels,

cloth industrial duct tape shall be adhered over all irregularities which could potentially puncture polyethylene membrane.

3.1.4 Vapor Retarder Installation

3.1.4.1 Integral Facing on Blanket Insulation

Integral facing on blanket insulation shall have the facing lapped and sealed with a compatible tap to provide a vapor tight membrane.

3.1.4.2 Polyethylene Vapor Retarder

*5 ~~The polyethylene vapor retarder membrane shall be installed over the entire surface. A fully compatible polyethylene tape shall be used to seal the edges of the sheets to provide a vapor tight membrane. Sheet edges shall be lapped not less than 150 mm (6 inches). Sufficient material shall be provided to avoid inducing stresses in the sheets due to stretching or binding. All tears or punctures that are visible in the finished surface at any time during the construction process shall be sealed with polyethylene tape.~~ Omitted

3.1.5 Slip Sheet Installation

A slip sheet shall be laid over the blanket insulation facing to prevent the vinyl facing from adhering to the metal roofing.

-- End of Section --

SECTION 07416

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

| | |
|---|---|
| AA-01 | (1993) Aluminum Standards and Data |
| AA SAS-30 | (1986) Aluminum Construction Manual Series - Section 1 Specifications for Aluminum Structures |

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

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

AMERICAN IRON AND STEEL INSTITUTE (AISI)

| | |
|---|---|
| AISI SG-673 | (1986; Addenda 1989) Cold-Formed Steel Design Manual |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 463 | (1994) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process |
| ASTM A 653 | (1994) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM A 792 | (1993a) Steel Sheet, 55 percent Aluminum-Zinc Alloy-Coated by the Hot-Dip Process, General Requirements |
| ASTM A 924 | (1994) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process |
| ASTM B 117 | (1994) Operating Salt Spray (Fog) Testing Apparatus |
| ASTM B 209 | (1993) Aluminum and Aluminum-Alloy Sheet and Plate |
| ASTM C 518 | (1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus |

| | |
|---|---|
| ASTM C 553 | (1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications |
| ASTM C 612 | (1993) Mineral Fiber Block and Board Thermal Insulation |
| ASTM C 1289 | (1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board |
| ASTM D 522 | (1993a) Mandrel Bend Test of Attached Organic Coatings |
| ASTM D 523 | (1989; R 1993) Specular Gloss |
| ASTM D 714 | (1987; R 1994) Evaluating Degree of Blistering of Paints |
| ASTM D 968 | (1993) Abrasion Resistance of Organic Coatings by Falling Abrasive |
| ASTM D 1308 | (1987; R 1993) Effect of Household Chemicals on Clear and Pigmented Organic Finishes |
| ASTM D 1654 | (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments |
| ASTM D 2244 | (1993) Calculation of Color Differences from Instrumentally Measured Color Coordinates |
| ASTM D 2247 | (1994) Testing Water Resistance of Coatings in 100 Percent 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 D 4397 | (1991) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications |
| ASTM E 84 | (1994a) Surface Burning Characteristics of Building Materials |
| ASTM E 96 | (1994) Water Vapor Transmission of Materials |
| ASTM E 1592 | (1994) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference |
| ASTM G 23 | (1995) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials |

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (1993) Minimum Design Loads for Buildings and Other Structures

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA-01 (1986; Errata; Supple 1990) Low Rise Building Systems Manual

STEEL JOIST INSTITUTE (SJI)

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

1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a manufacturer's standard product which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

1.2.1 Manufacturer

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

1.2.2 Installer

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

1.3 DESIGN REQUIREMENTS

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

1.3.1 Design Criteria

Design criteria shall be in accordance with ASCE 7 unless otherwise specified.

1.3.2 Dead Loads

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

1.3.3 Live Loads

1.3.3.1 Concentrated Loads

The panels and concealed anchor clips shall be capable of supporting a 1335 N (300-pound) temporary concentrated load at the panel midspan in the installed condition. The load shall be applied over the entire panel width. The panels shall support this concentrated load without displaying permanent distortions that would affect the weathertightness of the SSSMR system.

1.3.3.2 Uniform Loads

The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of 960 Pa 20 psf.

1.3.4 Roof Snow Loads

The design roof snow loads shall be as shown on the contract drawings.

1.3.5 Wind Loads

The design wind uplift pressure for the roof system shall be as shown on the contract drawings. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when figuring fastener design loads.

a. Single fastener in each connection.....3.0

b. Two or more fasteners in each connection...2.25

1.3.6 Thermal Loads

Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 122 degrees C (220 degrees F) during the life of the structure.

1.3.7 Framing Members Supporting the SSSMR System

Any additions/revisions to framing members supporting the SSSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. New or revised framing members and their connections shall be designed in accordance with AISC-S335. Maximum deflection under applied live load, snow, or wind load shall not exceed 1/180 of the span length.

1.3.8 Roof Panels

Steel panels shall be designed in accordance with AISI SG-673. Aluminum panels shall be designed in accordance with AA-01. Section modulus and moment of inertia of aluminum sheet shall be determined for actual cross section dimensions by the conventional methods for actual design stresses and by effective width concept for deflection in accordance with AA SAS-30. The structural section properties used in the design of the panels shall be determined using the unloaded shape of the roof panels. The calculated panel deflection from concentrated loads shall not exceed 1/180 of the span length. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length. Deflections shall be based on panels being continuous across three or more supports. Deflection shall be calculated and measured along the major ribs of the panels.

1.3.9 Accessories and Their Fasteners

Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. There shall be a minimum of two fasteners per clip. Single fasteners with a minimum diameter of 9 mm (3/8 inch) will be allowed when the supporting structural members are prepunched or predrilled.

## 1.4 PERFORMANCE REQUIREMENTS

The wind uplift resistance of the SSSMR shall be established by test in accordance with the requirements of ASTM E 1592. Two tests will be required. Test 1 should simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. For the edge condition the maximum span length is 750 mm (30 inches). Test 2 should simulate the interior condition with both ends free of crosswise restraint. For the interior condition the maximum span length is 1.5 m (5 feet). External reinforcement to improve uplift resistance, such as clamps on the ribs, is not acceptable.

## 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

Design Analysis; GA.

Design analysis signed by a Registered Professional Engineer. The design analysis shall include a list of the design loads, and complete calculations for the support system (when provided by the Contractor), roofing system and its components. The design analysis shall include calculations and indicate how expected thermal movements are accommodated.

SD-04 Drawings

Structural Standing Seam Metal Roof System; GA.

Contractor's drawings and specifications; and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealant(s) and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's proprietary products and fabricated items as required.

SD-08 Statements

Qualifications; GA.

Qualifications of the manufacturer and installer.

SD-09 Reports

Test Report for Uplift Resistance of the SSSMR; GA.

SSSMR systems previously tested and approved by the Corps of Engineer's STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE are still valid. SSSMR systems not previously tested by the Corps of Engineer's test shall be tested in accordance with ASTM E 1592. SSSMR systems tested and certified shall also meet the additional specified requirements of this Section. To verify that the SSSMR system tested is the same as that proposed for this project, the report shall include the following information:

a. Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.

b. Details of the anchor clip, dimensions, and thickness.

c. Type of fasteners, size, and the number required for each connection.

d. Purlins/subpurlins size and spacing used in the test.

e. Description of the seaming operation including equipment used.

f. Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.

g. Any additional information required to identify the SSSMR system tested.

h. Signature and seal of an independent registered engineer who witnessed the test.

SD-13 Certificates

Structural Standing Seam Metal Roof System; GA.

a. Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips comply with specified requirements.

b. Certification that materials used in the installation are mill certified.

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

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

Insulation; GA.

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

SD-14 Samples

Accessories; GA.

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

Roof Panels; GA.

One piece of each type to be used, 225 mm (9 inches) long, full width.

Factory Color Finish; GA.

Three 75 by 125 mm (3 by 5 inches) samples of each type and color.

Fasteners; GA.

Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to

the jobsite shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Insulation; GA.

One piece, 300 by 300 mm (12 by 12 inches), of each type and thickness to be used, with a label indicating the rated permeance (if faced) and R-values. The flame spread, and smoke developed rating shall be shown on the label or provided in a letter of certification.

Gaskets and Insulating Compounds; GA.

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

Sealant; GA.

One sample, approximately 0.5 kg (1 pound), and descriptive data.

Concealed Anchor Clips; GA.

Two samples of each type used.

Subpurlins; GA.

One piece, 225 mm (9 inches) long.

EPDM Rubber Boots; GA.

One piece of each type.

## 1.6 DELIVERY AND STORAGE

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

## 1.7 GUARANTEE

The SSSMR system shall be guaranteed for 20 years against leakage arising out of or 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.

# PART 2 PRODUCTS

## 2.1 ROOF PANELS

Panels shall be either steel or aluminum and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope when such slope is 9000 mm (30 feet) or less. When length of run exceeds 9000 mm (30 feet) and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than 9000 mm (30 feet) may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than 600 mm (24 inches) of coverage in place. SSSMR system with roofing panels greater than 300 mm (12 inches) in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than 50 mm (2 inches).

### 2.1.1 Steel Panels

Zinc-coated steel conforming to ASTM A 924 and ASTM A 653; aluminum-zinc alloy coated steel conforming to ASTM A 792, AZ 55 coating; or aluminum-coated steel conforming to ASTM A 463, Type 2, coating designation T2 65. Panels shall have a minimum thickness of 0.61 mm (0.024 inch), except that when the mid field of the roof is subject to design wind uplift pressures of 2870 Pa (60 psf) or greater the entire roof system shall have a minimum thickness of 0.76 mm. (0.030 inch.)

2.1.2 Aluminum Panels

Alloy conforming to ASTM B 209, temper as required for the forming operation, shall be a minimum of 0.81 mm (0.032 inch) thick.

2.2 CONCEALED ANCHOR CLIPS

Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.

2.3 ACCESSORIES

Accessories shall be compatible with the covering furnished. Flashing, trim, metal closure strips, caps, roof curbs, and similar metal accessories shall be not less than the minimum thicknesses specified for roofing panels. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the covering and shall not absorb or retain water. Thermal spacer blocks and other thermal barriers at concealed clip fasteners shall be as recommended by the manufacturer.

2.4 FASTENERS

Fasteners for steel roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear ultimate strengths of not less than 3340 N (750 pounds) per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the covering to waterproof the fastener penetration. Washer material shall be compatible with the covering; have a minimum diameter of 10 mm (3/8 inch) for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 3 mm (1/8 inch) thick. Exposed fasteners for factory color finished panels shall be factory finished to match the color of the panels.

2.4.1 Screws

Screws for attaching anchor devices shall be not less than No. 14. Other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

2.4.2 Bolts

Bolts shall be not less than 6 mm (1/4 inch) diameter, shouldered or plain shank as required, with locking washers and nuts.

### 2.4.3 Structural Blind Fasteners

Blind screw-type expandable fasteners shall be not less than 6 mm (1/4 inch) diameter. Blind (pop) rivets shall be not less than 7 mm (9/32 inch) minimum diameter.

## 2.5 SUBPURLINS

Subpurlins shall have a minimum thickness of 1.50 mm (0.059 inches) and a minimum yield strength of 345 MPa (50,000 psi).

## 2.6 FACTORY COLOR FINISH

Roof panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on fluoropolymer topcoat with an appropriate prime coat. Color shall match the color indicated in Section 09915 COLOR SCHEDULE. The exterior coating shall be a nominal 0.025 mm (1 mil) thickness consisting of a polyvinylidene fluoride topcoat of not less than 0.018 mm (0.7 mil) dry film thickness and the paint manufacturer's recommended primer of not less than 0.005 mm (0.2 mil) thickness. The interior color finish shall consist of a backer coat with a dry film thickness of 0.013 mm (0.5 mil) thick prime coat. The exterior color finish shall meet the test requirements specified below.

### 2.6.1 Salt Spray Test

A sample of the sheets shall withstand a salt spray test for a minimum of 1,000 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 (1/8 inch) failure at scribe, as determined by ASTM D 1654.

### 2.6.2 Formability Test

When subjected to testing in accordance with ASTM D 522, the coating film shall show no evidence of fracturing to the naked eye.

### 2.6.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested for a minimum of 1,000 hours in accordance with ASTM G 23, Method 2, using a Type EH apparatus with cycles of 60 minutes radiation and 60 minutes condensing humidity. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

### 2.6.4 Humidity Test

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

### 2.6.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 equal to 1.5 times metal thickness in mm (mils), expressed in newton-meter (inch-pounds), with no loss of adhesion.

2.6.6 Abrasion Resistance Test

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

2.6.7 Specular Gloss *Omitted*

2.6.8 Pollution Resistance

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

2.7 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 24 degrees C (75 degrees F) in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation, including facings, shall have a flame spread not in excess of 75 and a smoke developed rating not in excess of 150 when tested in accordance with ASTM E 84. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory.

2.7.1 Rigid Board Insulation for Use Above a Roof Deck

2.7.1.1 Polyurethane or Polyisocyanurate

Polyurethane or polyisocyanurate insulation shall conform to ASTM C 1289, Type I, Class 2 (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For impermeable faced polyisocyanurate (Ex: aluminum foil) the maximum design R-value per 25 mm (1 inch) of insulation used shall be 1.27 (7.2).

2.7.1.2 Mineral Fiber

Insulation shall conform to ASTM C 612.

2.7.2 Blanket Insulation *Omitted*

2.8 INSULATION RETAINERS

Insulation retainers shall be type, size, and design necessary to adequately hold the insulation and to provide a neat appearance. Metallic retaining members shall be nonferrous or have a nonferrous coating. Nonmetallic retaining members, including adhesives used in conjunction with mechanical retainers or at insulation seams, shall have a fire resistance classification not less than that permitted for the insulation.

2.9 SEALANT

Sealants shall be 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. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

## 2.10 GASKETS AND INSULATING COMPOUNDS

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

## 2.11 VAPOR RETARDER

### 2.11.1 Vapor Retarders as Integral Facing

Insulation facing shall have a permeability of 5.7 ng per Pa-second-square meter 0.1 perm or less when tested in accordance with ASTM E 96. Facing shall be gray of reinforced foil with a vinyl finish; except that unreinforced foil with a natural finish may be used in concealed locations. Facings and finishes shall be factory applied.

### 2.11.2 Vapor Retarders Separate from Insulation

Vapor retarder material shall be polyethylene sheeting conforming to the requirements of ASTM D 4397. A single ply of 0.25 mm (10 mil) polyethylene sheet; or, at the option of the Contractor, a double ply of 0.15 mm (6 mil) polyethylene sheet shall be used. A fully compatible polyethylene tape shall be provided which has equal or better water vapor control characteristics than the vapor retarder material. A cloth industrial duct tape in a utility grade shall also be provided to use as needed to protect the vapor retarder from puncturing.

### 2.11.3 Slip Sheet for Use With Vapor Retarder

Slip sheet for use with vapor retarder shall be a 0.24 kg per square meter (5 per 100 square foot) rosin-sized, unsaturated building paper.

## 2.12 EPDM RUBBER BOOTS

Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

# PART 3 EXECUTION

## 3.1 INSTALLATION

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

cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

### 3.1.1 Field Forming of 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.

### 3.1.2 Subpurlins

Unless otherwise shown, subpurlins shall be anchored to the purlins or other structural framing members with bolts or screws. The subpurlin spacing shall not exceed 750 mm (30 inches) on centers at the corner, edge and ridge zones, and 1500 mm (5 foot) maximum on centers for the remainder of the roof. Corner, edge, and ridge zones are as defined in ASCE 7.

### 3.1.3 Roof Panel Installation

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

### 3.1.4 Concealed Anchor Clips

Concealed anchor clips shall be fastened directly to the structural framing members. The maximum distance, parallel to the seams, between clips shall be 750 mm (30 inches) on center at the corner, edge, and ridge zones, and 1500 mm (5 feet) maximum on centers for the remainder of the roof.

## 3.2 INSULATION INSTALLATION

Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

### 3.2.1 Board Insulation with Blanket Insulation

Rigid or semirigid board insulation shall be laid in close contact. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. A layer of blanket insulation shall be placed over the rigid or semirigid board insulation to be compressed against the underside of the metal roofing to reduce thermal bridging, dampen noise, and prevent roofing flutter. This layer of blanket insulation shall be compressed a minimum of 50 percent.

### 3.2.2 Blanket Insulation *Omitted*

## 3.3 PROTECTION OF VAPOR RETARDER FROM ROOF DECK

A cloth industrial duct tape shall be adhered over all the seams of metal roof decking, at any penetration edges, and at all surface areas exhibiting sharp burrs or similar protrusions. For other types of roof decking, cloth industrial duct tape shall be adhered over all irregularities which could potentially puncture polyethylene membrane.

## 3.4 VAPOR RETARDER INSTALLATION

### 3.4.1 Integral Facing on Blanket Insulation

Integral facing on blanket insulation shall have the facing lapped and sealed with a compatible tap to provide a vapor tight membrane.

### 3.4.2 Polyethylene Vapor Retarder *Omitted*

## 3.5 SLIP SHEET INSTALLATION

A slip sheet shall be laid over the blanket insulation facing to prevent the vinyl facing from adhering to the metal roofing.

## 3.6 CLEANING AND TOUCH-UP

Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.

-- End of Section --

SECTION 07600

SHEET METALWORK, GENERAL

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167 (1993) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM B 32 (1993) Solder Metal

ASTM B 209 (1993) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221 (1993) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

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

ASTM D 226 (1994) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

ASTM D 1784 (1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D 2822 (1991) Asphalt Roof Cement

ASTM D 3656 (1989) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

ASTM D 4022 (1994) Coal Roof Cement, Asbestos Containing

ASTM D 4586 (1993) Asphalt Roof Cement, Asbestos Free

INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

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

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA)

SMACNA-02 (1993) Architectural Sheet Metal Manual

1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion and shall allow for expansion and contraction.

1.2.1 Coordination

Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations. Sheet metalwork pertaining to heating, ventilating and air conditioning is specified in Section 15895.

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

Materials; FIO.

Drawings of sheet metal items showing weights, gauges or thicknesses; types of materials; expansion-joint spacing; fabrication details and installation procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage. Materials shall be stored in dry, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Prefinished aluminum or steel.

2.1.1 Accessories

Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided.

2.1.2 Aluminum Extrusions

ASTM B 221, Alloy 6063, Temper T5.

2.1.3 *Omitted*

2.1.4 Sealant

Unless otherwise specified, sealant shall be an elastomeric weather resistant sealant as specified in Section 07920 JOINT SEALING.

2.1.5 Fasteners

Fasteners shall be compatible with the fastened material and shall be the type best suited for the application.

2.1.6 Felt

ASTM D 226, Type I.

2.1.7 Polyvinyl Chloride (PVC) Reglets

ASTM D 1784, Class 14333D, 1.9 mm (0.075 inch) minimum thickness.

2.1.8 Aluminum Alloy Sheet and Plate

ASTM B 209, clad form, alloy and temper appropriate for use.

2.1.9 Copper

ASTM B 370, Temper H 00.

2.1.10 Stainless Steel

ASTM A 167, Type 302 or 304; fully annealed, dead soft temper.

2.1.11 Solder

ASTM B 32, 95-5 tin-antimony.

2.1.12 Through-Wall Flashing

Flashing shall be copper, copper-clad stainless steel or stainless steel having factory-formed deformations providing mechanical bond in mortar joints. Minimum metal thickness shall be as listed below:

a. Copper: Above the roof line - 16 ounces per square foot
Below the roof line - 10 ounces per square foot

b. Cooper-clad stainless steel: Above the roof line - 0.015 inch thick
Below the roof line - 0.010 inch thick

c. Stainless steel: Above the roof line - 0.015 inch thick
Below the roof line - 0.010 inch thick

2.1.13 Louver Screen

Type I commercial bronze insect screening conforming to ISWA IWS 089.

PART 3 EXECUTION

3.1 GENERAL

Items such as gutters, downspouts and louvers shall be fabricated in conformance with Drawings as indicated. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 13 mm (1/2 inch) hem on the concealed side and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing.

3.2 EXPANSION JOINTS

Expansion joints shall be provided as indicated on Drawings. Expansion joints in continuous sheet metal shall be provided at 12 meter (40-foot) intervals for copper and stainless steel and at 9.6 meter (32-foot) intervals for aluminum, except extruded aluminum gravel stops and fasciae which shall have expansion joints at not more than 3.6 meter (12-foot) spacing. Joints shall be evenly spaced. An additional joint shall be provided where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing.

## 3.3 PROTECTION OF ALUMINUM

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

### 3.3.1 Paint

Aluminum surfaces shall be factory prefinished polyvinylidene fluoride (PVFZ) based enamel.

### 3.3.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and cemented to the aluminum surface using a cement compatible with aluminum.

## 3.4 CONNECTIONS AND JOINTING

### 3.4.1 Soldering

Soldering shall apply to copper, and stainless steel items. Edges of sheet metal shall be pretinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

### 3.4.2 Riveting

Joints in aluminum sheets 1.0 mm (0.040 inch) or less in thickness shall be mechanically made.

### 3.4.3 Seaming

Flat-lock and soldered-lap seams shall finish not less than 25 mm (1 inch) wide. Unsoldered plain-lap seams shall lap not less than 75 mm (3 inches) unless otherwise specified. Flat seams shall be made in the direction of the flow.

## 3.5 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 3 mm (1/8 inch) apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 300 mm (12 inches) on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

## 3.6 GUTTERS AND DOWNSPOUTS

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

## 3.7 FLASHINGS

Flashings shall be installed at locations indicated and as specified below. Sealing shall be according to the flashing manufacturer's recommendations. Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof and floor drains and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement. Flashing shall be formed to direct water to the outside of the system.

3.7.1 *Omitted*
3.7.2 *Omitted*
3.7.3 *Omitted*

3.7.4 Through-Wall Flashing

Through-wall flashing includes sill, lintel and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further into the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

3.7.4.1 Lintel Flashing

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 50 mm (2 inches), or shall be applied over top of masonry and precast concrete lintels. Bedjoints of lintels at control joints shall be underlaid with sheet metal bond breaker.

3.7.4.2 Sill Flashing

Sill flashing shall extend the full width of the sill and not less than 100 mm (4 inches) beyond ends of sill except at control joint where the flashing shall be terminated at the end of the sill.

3.7.5 Valley Flashing

Valley flashing shall be installed as specified in Section 07413 as part of the roof covering system and in accordance with the manufacturer’s recommendation.

3.8 *OMITTED*

3.9 INSTALLATION OF LOUVERS

Louvers shall be rigidly attached to the supporting construction. The installation shall be rain-tight. Louver screen shall be installed as indicated.

3.10 REGLETS

Reglets shall be a factory fabricated product of proven design, complete with fittings and special shapes as required. Open-type reglets shall be filled with fiberboard or other suitable separator to prevent crushing of the slot during installation. Reglet plugs shall be spaced not over 300 mm (12 inches) on centers and reglet grooves shall be filled with sealant. Friction or

slot-type reglets shall have metal flashings inserted the full depth of slot and shall be lightly punched every 300 mm (12 inches) to crimp the reglet and counter flashing together. Polyvinyl chloride reglets shall be sealed with the manufacturer's recommended sealant.

## 3.11 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.

b. Verification of compliance of materials before, during and after installation.

c. Inspection of sheet metalwork for proper size and thickness, fastening and joining and proper installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer at the end of each day.

-- End of Section --

SECTION 07920

JOINT SEALING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM C 509 | (1994) Elastomeric Cellular Preformed Gasket and Sealing Material |
| ASTM C 570 | (1994) Oil- and Resin-Base Caulking Compound for Building Construction |
| ASTM C 734 | (1993) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering |
| ASTM C 834 | (1991) Latex Sealants |
| ASTM C 920 | (1987) Elastomeric Joint Sealants |
| ASTM C 1085 | (1991) Butyl Rubber-Based Solvent-Release Sealants |
| ASTM C 1184 | (1991) Structural Silicone-Sealants |
| ASTM D 217 | (1994) Cone Penetration of Lubricating Grease |
| ASTM D 1056 | (1991) Flexible Cellular Materials - Sponge or Expanded Rubber |
| ASTM D 1565 | (1981; R 1990) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam) |
| ASTM E 84 | (1995) Surface Burning Characteristics of Building Materials |

1.2 SUBMITTALS

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

SD-01 Data

Backing; FIO. Bond-Breaker; FIO. Sealant; FIO.

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

SD-13 Certificates

Sealant; FIO.

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 4 to 32 degrees C (40 to 90 degrees F) when the sealants are applied.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall include the following information as applicable: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures between 4 and 32 degrees C (40 and 90 degrees F) unless otherwise specified by the manufacturer.

PART 2 PRODUCTS

2.1 BACKING

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

2.1.1 Rubber Backing

Cellular rubber sponge backing A shall be ASTM D 1056, Type 2, closed cell, Class A, Grade C round cross section.

2.1.2 PVC Backing

Polyvinyl chloride (PVC) backing B shall be ASTM D 1565, Grade B, open-cell foam, round cross section.

2.1.3 Synthetic Rubber Backing

Synthetic rubber backing C shall be ASTM C 509, Option I, Type I preformed rods.

2.2 BOND-BREAKER

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.3 PRIMER

Primer shall be non-staining type as recommended by sealant manufacturer for the application.

2.4 CAULKING

Oil- and resin-based caulking, A shall be ASTM C 570, Type S, Use NT.

2.5 LATEX SEALANT

Latex sealant, A shall be ASTM C 834.

## 2.6 ELASTOMERIC SEALANTS

Elastomeric sealants shall conform to ASTM C 920 and the following:

a. Polysulfide Sealant B: Polysulfide sealant, Type S, Grade NS, Class 25, Use NT, M.

b. Polyurethane Sealant C: Polyurethane sealant, Grade NS, Class 25, Use T.

c. Silicone Sealant D: Silicone sealant, Type S, Grade NS, Class 25, Use NT, A.

## 2.7 ACOUSTICAL SEALANT

Rubber or polymer-based acoustical sealant F shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84. Acoustical sealant shall have a consistency of 250 to 310 when tested in accordance with ASTM D 217, and shall remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C 734, and shall be non-staining.

## 2.8 BUTYL SEALANT

Butyl sealant, G shall be ASTM C 1085.

## 2.9 PREFORMED SEALANT

Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 34 to plus 71 degrees C (30 to plus 160 degrees F), the sealant shall be non-bleeding and shall have no loss of adhesion.

### 2.9.1 Tape Sealant

Tape sealant, H: cross-section dimensions shall be 12.

### 2.9.2 Bead Sealant

Bead sealant, I: cross-section dimensions shall be 9.

### 2.9.3 Foam Strip

Foam strip J shall be polyurethane foam; cross-section dimensions shall be 12. Foam strip shall be capable of sealing out moisture, air, and dust when installed and compressed as recommended by the manufacturer. Service temperature shall be minus 40 to plus 135 degrees C (minus 40 to plus 275 degrees F). Untreated strips shall be furnished with adhesive to hold them in place. Adhesive shall not stain or bleed into adjacent finishes. Treated strips shall be saturated with butylene waterproofing or impregnated with asphalt.

## 2.10 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

# PART 3 EXECUTION

## 3.1 GENERAL

### 3.1.1 Surface Preparation

The surfaces of joints to be sealed shall be dry. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant. Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths.

### 3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

### 3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

### 3.1.4 Aluminum Surfaces

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

### 3.1.5 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

## 3.2 APPLICATION

### 3.2.1 Masking Tape

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

### 3.2.2 Backing

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

### 3.2.3 Bond-Breaker

Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

### 3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

3.2.5 Sealant

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be tooled so that the surface is uniformly smooth and free of wrinkles and to assure full adhesion to the sides of the joint. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

3.4 APPLICATION SCHEDULE

3.4.1 Exterior Joints

| Condition | Joint Filler Material |
|---|---|
| Joints in wood framing or wood blocking concealed | Caulk Type A |
| Cast-In-Place Concrete Horizontal Surface Traffic Joints | Sealant - Elastomeric Type B |
| Cast-In-Place Concrete Vertical Surfaces - Concealed | Sealant - Elastomeric Type D |
| Unit Masonry - Brick Control Joint and Expansion Joint Exposed | Sealant - Elastomeric Type D |
| Unit masonry brick to dissimilar materials door, window and louver frames and metal fascia | Sealant Butyl Sealant G |
| Metal Roof Panels Concealed Areas | Preformed Sealant Tape or Bead |
| Metal Roof Panels Exposed | Sealant Elastomeric Type C |
| Metal Soffit and Fasic Panels | Sealant Elastomeric Type C |
| Seismic - Concealed Joints in CMU | Form strip |

3.4.2 Interior

| | |
|---|---|
| Control and Expansion Joints at interior surfaces of exterior walls | Sealant Elastomeric Type B |

| | |
|---|---|
| Perimeters of doors windows and louvers | Latex Sealant Type A |
| Ceramic tile wall control and expansion joints | Sealant Elastomeric Type D |
| Quarry tile floor joints | Sealant Elastomeric Type C |
| Acoustical sound walls around private offices, toilets and conference rooms at floors, intersections of walls with partitions and walls and ceiling. Penetrations in non-fire rated walls - all concealed spaces | Acoustical sealant |
| Concrete Floor Joints | Sealant Elastomeric Type C |

-- End of Section --

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

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; F10

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; FIO. Thermal Insulated Doors; FIO. Security Doors; FIO. Sound Rated Doors; FIO.

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 Security Door, Sound Thermal Insulating Rating: Certification or test report for security rating, sound rated 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

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. Indicated interior 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 08700 DOOR 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 knockdown type and welded type located as shown. Knock down frames to be used in metal stud partitions and welded frames shall be used in masonry wall and partitions. 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 (18 gauge) steel or 4.5 mm (7 gauge) diameter wire. For wall conditions that do not allow the use of a floor anchor, an additional jamb anchor shall be provided. Rubber silencers shall be furnished for installation into factory predrilled holes in door frames; adhesively applied silencers are not acceptable. Where frames are installed in plaster or masonry walls, plaster guards shall be provided on door frames at hinges and strikes. Full glass doors shall conform to SDOI SDI-100, Model 3, and shall include provisions for glazing. Reinforcing of door assemblies for closers and other required hardware shall be in accordance with SDOI SDI-100 and the conditions of the fire door assembly listing when applicable. Exterior doors shall have top edges closed flush and sealed against water penetration.

## 2.2 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 (0.41 btu/hr times sq f times f) when tested as an operational assembly in accordance with ASTM C 236 or ASTM C 976. Doors with cellular plastic cores shall have a minimum oxygen index rating of 22 percent when tested in accordance with ASTM D 2863.

## 2.4 SECURITY DOORS

Security type doors and frames shall be factory fabricated in accordance with NAAMM HMMA 862 and the additional requirements specified herein. Doors and frames shall be galvanized 1.7 mm (14 gauge) construction. Doors shall have 1.7 mm (14 gauge) steel plate on both sides, and be internally reinforced vertically with continuous 1.0 mm (20 gauge) steel stiffeners spaced 150 mm (6 inches) on center maximum. Doors shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Door thickness shall be 44.5 mm (1-3/4 inches). Exterior doors shall be insulated to provide a thermal conductance (U-value) not to exceed 2.33 W/ sq m times K (0.41 btu/hr times sq f times f) when tested as an operational assembly in accordance with ASTM C 236 or ASTM C 976. Doors with cellular plastic cores

shall have a minimum oxygen index rating of 22 percent when tested in accordance with ASTM D 2863. Door frames shall be all welded type, with double rabbet jamb profile. At meeting stiles, an astragal shall be provided by extending the face panel of the active leaf not less than 16 mm (5/8 inch) across the gap between the two leaves. Astragal shall be flush with the face panel of the inactive leaf. Frame corners shall be machine-mitered, full (continuously) welded. All exposed welds shall be ground and finished smooth.

## 2.5 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 (18 gauge) minimum thickness door, 1.7 mm (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.

## 2.6 WEATHERSTRIPPING

Unless otherwise specified in Section 08700 DOOR 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 (0.20 cfm per linear foot) of crack when tested in accordance with ASTM E 283 at standard test conditions.

## 2.7 TRANSOM AND SIDELIGHT PANELS

Panels for transom shall be constructed in accordance with SDOI SDI-100. Panels shall be nonremovable from the outside of exterior doors or the unsecure side of interior doors.

## 2.8 LOUVERS

Where indicated, doors shall be provided with full louvers or louver sections. Louvers shall be sightproof type inserted into the door. Pierced louvers shall not be used on exterior doors. 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.

## 2.9 GLAZING

Glazing shall be as specified in Section 08810 GLASS AND GLAZING. Removable glazing beads shall be screw-on or snap-on type.

## 2.10 FACTORY FINISH

Doors and frames shall be phosphatized and primed with standard factory primer system. Color shall be gray.

# 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 Security Doors

Door frames shall be rigidly anchored in place and provided with antispread space filler reinforcements to prevent disengagement of the lock bolt by prying or jacking of the frame. Jambs shall be filled solid with concrete grout.

### 3.1.3 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.

## 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 in accordance with Section 09915 COLOR SCHEDULE.

-- End of Section --

SECTION 08120

ALUMINUM 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.

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1980) Designation System for Aluminum Finishes

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

1.2 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, trim, and other accessories indicated and specified.

1.3 OMITTED

1.4 SUBMITTALS

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

SD-01 Data

Aluminum Doors and Frames; GA.

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 and Flush Doors; GA.

For full-glazed and flush 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-14 Samples

Finishes; FIO.

Samples of the color anodized coating, showing the extreme color range painted finish.

## 1.5 DELIVERY AND STORAGE

Materials delivered to the jobsite shall be inspected for damage, and shall be unloaded with a minimum of handling. Storage shall be in a dry location with adequate ventilation, free from dust, water, and other contaminants, and which permits easy access for inspecting and handling. Materials shall be neatly stored on the floor, properly stacked on nonabsorptive strips or wood platforms. Doors and frames shall not be covered with tarps, polyethylene film, or similar coverings.

## 1.6 WARRANTY

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

# PART 2 PRODUCTS

## 2.1 ALUMINUM DOORS AND FRAMES

Extrusions shall comply with ASTM B 221, Alloy 6063-T5 except alloy used for anodized color coatings shall be required to produce the specified color. Aluminum sheets and strips shall comply with ASTM B 209, alloy and temper best suited for the purpose. Fasteners shall be hard aluminum or stainless steel.

### 2.1.1 Finishes

Finish shall be clear anodized, color anodized. Color anodized finish shall be AA-M10C22A42 and AA-M10C22A44 in accordance with the requirements of AA DAF-45. Color shall be in accordance with Section 09915 COLOR SCHEDULE.

### 2.1.2 Welding and Fastening

Where possible, welds shall be located on unexposed surfaces. Welds required on exposed surfaces shall be smoothly dressed. Welding shall produce a uniform texture and color in the finished work, free of flux and spatter. Exposed screws or bolts will be permitted only at inconspicuous locations and shall have heads countersunk.

### 2.1.3 Anchors

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 (25 inches) apart. Transom bars shall be anchored at ends, and mullions shall be anchored at head and sill. The bottom of each frame shall be anchored to the rough floor construction with 2.4 mm (3/32 inch) thick stainless steel angle clips secured to the back of each jamb and to floor construction. Stainless steel bolts and expansion rivets shall be used for fastening clip anchors. Freestanding door frames shall be reinforced and securely anchored to floor construction.

### 2.1.4 Provisions For Hardware

Hardware for aluminum doors is specified in Section 08700 DOORS' HARDWARE. Doors and frames shall be cut, reinforced, drilled, and tapped at the factory to receive template hardware. Reinforcement shall be provided in the core of doors as required to receive locks, door closers, and other hardware. Doors to receive surface applied hardware shall be reinforced as required.

### 2.1.5 Provisions For Glazing

Glazing shall be as specified in Section 08810 GLASS AND GLAZING. Metal glazing beads, vinyl inserts, and glazing gaskets shall be provided for securing glass. Glass stops shall be tamperproof on exterior side.

### 2.1.6 Weatherstripping

Weatherstripping shall be continuous silicone-treated wool pile type, or a type recommended by the door manufacturer, and shall be provided on head and jamb of exterior doors. Weatherstripping for bottom of doors shall be as shown. Weatherstripping shall be easily replaced without special tools, and shall be adjustable at meeting stiles of pairs of doors. Air leakage rate of weatherstripping shall not exceed 0.775 L/s per lineal meter (0.5 cfm per lineal foot) of crack when tested in accordance with ASTM E 283 at standard test conditions.

## 2.2 FABRICATION OF ALUMINUM FRAMES

Frames shall be single-glazed. 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 (0.090 inch), except glazing beads, moldings, and trim shall be not less than 1.27 mm (0.050 inch). Frames that are to receive glass shall have removable snap-on glass stops and glazing beads. Joints in frame members shall be milled to a hairline watertight fit, reinforced, and secured mechanically by steel clip arrangement or by screw spline attachment.

## 2.3 FABRICATION OF ALUMINUM DOORS

2.3.1 Sizes, Clearances, and Edge Treatment

Doors shall be not less than 44.4 mm (1-3/4 inches) thick. Clearances shall be 1.6 mm (1/16 inch) at hinge stiles, 3 mm (1/8 inch) at lock stiles and top rails, and 5 mm (3/16 inch) at floors and thresholds. Single-acting doors shall be beveled 3 mm (1/8 inch) 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 wide 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 (3/8 inch) 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.

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.

-- End of Section --

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 HARDBOARD ASSOCIATION (AHA)

AHA 135.4 (1982; R 1988) Basic Hardboard

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

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

NWWDA I.S. 4 (1994) Water-Repellent Preservative Non-Pressure Treatment for Millwork

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Doors shall be of the type, size, and design indicated on the drawings, and shall be the standard products of manufacturers regularly engaged in the manufacture of wood doors.

1.2.2 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door. The identifying mark or a separate certification shall include identification of the standard on which

construction of the door is based, identity of the manufacturing plant, identification of the standard under which preservative treatment, if used, was made, and identification of the doors having a Type I glue bond.

1.3 SUBMITTALS

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

SD-04 Drawings

Wood Doors and Frames; 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; FIO.

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.

SD-14 Samples

High Pressure Laminate Doors; FIO. Factory Coated Natural Finish; FIO. Factory Coated Paint Finish; FIO.

Samples of factory applied natural and paint finish.

1.4 STORAGE

Doors shall be stored in fully covered areas and protected from damage and from extremes in temperature and humidity. Doors shall be stored on supports to prevent warping or twisting, and to provide ventilation. Factory cartons or wrappers shall be kept intact until installation.

1.5 HARDWARE

Hardware, including weatherstripping and thresholds, is specified in Section 08700 DOOR HARDWARE.

1.6 GLAZING

Glazing is specified in Section 08810 GLASS AND GLAZING.

1.7 WARRANTY

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

PART 2 PRODUCTS

2.1 GENERAL FABRICATION REQUIREMENTS

2.1.1 Edge Sealing

Wood end-grain exposed at edges of doors shall be sealed prior to shipment.

2.1.2 Preservative Treatment

Exterior softwood doors shall be water-repellent preservative treated in accordance with NWWDA I.S. 4.

2.1.3 Adhesives

Adhesives shall be in accordance with NWWDA I.S. 1-A, requirements for Type I Bond Doors (waterproof) for exterior doors and requirements for Type II Bond Doors (water-repellent) for interior doors. Adhesive for doors to receive a transparent finish shall be nonstaining.

2.1.4 Prefitting

Doors shall be furnished prefitted or unfitted at the option of the Contractor, except plastic laminate clad doors shall be furnished prefit in accordance with the standards under which they are produced.

2.2 FLUSH DOORS

Flush doors shall be solid core and shall conform to NWWDA I.S. 1-A, except for the 1 year acclimazation requirement in paragraph T-2, which shall not apply. Wood doors shall be 5-ply or 7-ply construction with faces, stiles, and rails bonded to the cores.

2.2.1 Core Construction

2.2.1.1 Solid Cores

Door construction shall be glued wood block core, particle board core or mineral core with vertical and horizontal edges bonded to the core. Blocking and hardware reinforcements for particle board and mineral core doors shall be blocking option HB-1-5 in accordance with NWWDA I.S. 1-A.

2.2.2 Face Panels

2.2.2.1 Natural Finished Wood Veneer Doors

Veneer doors to receive natural finish shall be Custom Grade veneer white oak in accordance with NWWDA I.S. 1-A. Vertical stile strips shall be selected to provide edges of the same species and/or color as the face veneer. Door finish shall be in accordance with paragraph FINISHING.

2.2.2.2 Painted Wood Veneer Doors

Veneer doors to receive paint finish shall be Economy Grade in accordance with NWWDA I.S. 1-A. Door finish shall be in accordance with paragraph FIELD FINISHING.

2.3 *OMITTED*

2.3.1 *Omitted*

2.3.2 Natural Finished Doors

Doors to receive natural finish shall be Premium Grade or Custom Grade White Oak in accordance with AWI-02. Finish shall be in accordance with paragraph FINISHING.

2.3.3 Painted Doors

Doors to receive paint finish shall be Custom Grade in accordance with AWI-02. Finish shall be in accordance with paragraph FIELD FINISHING.

2.4 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 45, 60, 90 or particleboard core 20, 30 or staved lumber core 20, 30 minute rating.

2.4.1 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.

2.4.2 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.

2.5 *OMITTED*
2.6 *OMITTED*
2.7 *OMITTED*

2.8 FINISHING

2.8.1 Factory Coated Natural Finish

Doors indicated to receive factory coated natural finish shall be given a transparent finish conforming to AWI-02, Section 1500, Custom Grade, light stain, full gloss sheen, close grain effect. Finish shall be AWI factory finish system Number TR3 or TR4. Color of the natural finish shall be in accordance with Section 09915 COLOR SCHEDULE. Edges of unfitted doors shall be field finished after fitting to the frames.

PART 3 EXECUTION

3.1 INSTALLATION OF DOORS

3.1.1 General Use Doors

Doors shall be fit, hung, and trimmed as required. Door shall have a clearance of 3 mm (1/8 inch) at the sides and top and shall have a bottom clearance of 6 mm (1/4 inch) over thresholds and 13 mm (1/2 inch) at other locations unless otherwise shown. The lock edge or both edges of doors shall be beveled at the rate of 3 mm (1/8 inch) in 50 mm (2 inches). Cuts made on the job shall be sealed immediately after cutting, using a clear varnish or

sealer. Bottom of doors shall be undercut to allow clear door swing over carpeted areas. Vertical edges of doors which have not been rounded or beveled at the factory shall be eased when the doors are installed.

3.1.2 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 *OMITTED*

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 in accordance with Section 09915 COLOR SCHEDULE. Field touch-up of factory finishes shall be in accordance with manufacturers instructions.

-- End of Section --

SECTION 08318

SECURITY-VAULT DOOR

PART 1 GENERAL

1.1 REFERENCES

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

FEDERAL SPECIFICATION (FS)

FS AA-D-00600 (Rev C) Door, Vault, Security

1.2 GENERAL REQUIREMENTS

The vault door unit shall be a steel security-vault type door with frame, day gate, and flush type threshold, and shall be a standard product of a manufacturer specializing in this type of fabrication.

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

Security Vault Door; FIO.

Manufacturer's catalog data including catalog cuts and brochures. The data shall show that the proposed vault door unit conforms with the requirements in FS AA-D-00600, and has been tested and approved by the General Services Administration (GSA).

SD-13 Certificates

Security Vault Door; FIO.

Certification shall state that vault-door units that do not bear the GSA label are constructed to Class 5 standards.

1.4 DELIVERY AND STORAGE

Door and frame assemblies shall be delivered to the jobsite in a protective covering with the brand and name clearly marked thereon. Materials delivered to the jobsite shall be inspected for damage, and 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 inspection and handling. Door assemblies shall be stored off the floor on nonabsorptive strips or wood platforms. Doors and frames 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 VAULT DOOR AND FRAME

Design and construction of the door and frame assembly shall conform to FS AA-D-00600. The door shall be Class 5, Type IIR - left opening swing without optical device. Style K - key change combination lock.

## 2.2 DAY GATE

The day gate shall be the manufacturer's modified standard product designed for use with the vault door furnished, and shall provide access control and visual security and weapons pass-through. The gate shall be hinged on the same side as the vault door, shall swing into the vault, and shall have two locking devices operable from outside by key and from inside by knob or handle and shall be a split-dutch door design.

# PART 3 EXECUTION

## 3.1 INSTALLATION

The vault door assembly shall be installed in strict compliance with the printed instructions and drawings provided by the manufacturer. The day gate shall be installed in a manner that will not interfere with operation of the release handle on the inside of the vault door. After installation, the door, the locking mechanism, and the inner escape device shall be adjusted for proper operation.

-- End of Section --

SECTION 08330

OVERHEAD ROLLING DOORS

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

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

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

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

ASHRAE-81930 (1993) Handbook, Fundamentals I-P Edition

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (1993) Industrial Control Devices, Controllers and Assemblies

NEMA ICS 6 (1993) Enclosures for Industrial Control and Systems

NEMA MG 1 (1993; Rev 1-1993; Rev 2-1995) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996) National Electrical Code

NFPA 80 (1995) Fire Doors and Windows

1.2 DESCRIPTION

Overhead rolling doors shall be spring counterbalanced, rolling type, with interlocking slats, complete with guides, fastenings, hood, brackets, and operating mechanisms, and shall be designed for use on openings as indicated. Fire doors shall bear the Underwriters Laboratories, Warnock Hersey, Factory Mutual or other nationally recognized testing laboratory label for the rating listed on the drawings. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model number of the door. Doors in excess of the labelled size shall be deemed oversize and shall be provided with a certificate signed by an official of the company, certifying that the door and operator have been designed to meet the specified requirements.

1.2.1 Wind Load Requirements

Doors and components shall be designed to withstand the minimum design wind load of 1580 Pa (33 psf). Doors shall be constructed to sustain a superimposed load, both inward and outward, equal to 1-1/2 times the minimum design wind load. The door shall support the superimposed loads for a minimum period of 10 seconds without evidence of serious damage and shall be operable after conclusion of the tests. Test data showing compliance with design windload requirements for the door design tested in accordance with a uniform static load equal to 1-1/2 times the minimum design windload, shall be provided. The uniform static load test specimen shall be supported using guides, endlocks, and windlocks as required for project installation. Recovery shall be at least 3/4 of the maximum deflection within 24 hours after the test load is removed.

1.2.2 Operational Cycle Life

All portions of the door and door operating mechanism that are subject to movement, wear, or stress fatigue shall be designed to operate through a minimum of 10,000 cycles. One complete cycle of door operation will begin with the door in the closed position, move to the full open position and return to the closed position.

1.3 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

Overhead Rolling Door Unit; FIO.

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

SD-04 Drawings

Overhead Rolling Door Unit; FIO.

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

SD-06 Instructions

Overhead Rolling Door Unit; FIO.

Manufacturer's preprinted installation instructions.

1.4 DELIVERY AND STORAGE

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

1.5 WARRANTY

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

## 1.6 OPERATION AND MAINTENANCE MANUALS

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

# PART 2 PRODUCTS

## 2.1 OVERHEAD ROLLING DOORS

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

### 2.1.1 Curtains

The curtains shall roll up on a barrel supported at the head of opening on brackets, and shall be balanced by helical springs. Steel slats for doors from 4.5 m to 6.3 m (15 feet wide to 21 feet) wide shall be minimum bare metal thickness of 1.0 mm (20 gauge) (0.0329 inch. Slats shall be of the minimum bare metal decimal thickness required for the width indicated and the wind pressure specified above. Slats for fire doors over 3.6 m (12 feet) wide and under 6 m (20 feet) wide shall be not less than 1.0 mm (20 gauge) steel.

#### 2.1.1.1 *Omitted*

#### 2.1.1.2 Insulated Curtains

The slat system shall supply a minimum R-value of 5 when calculated in accordance with ASHRAE-81930. Slats shall be of the flat type as standard with the manufacturer. Slats shall consist of a urethane core not less than 17 mm (11/16 inch) thick, completely enclosed within metal facings. Exterior face of slats shall be gauge as specified for curtains. Interior face shall be not lighter than 0.70 mm (24 gauge). Insulation shall have a flame spread rating of not more than 25 and a smoke development factor of not more than 50 when tested in accordance with ASTM E 84.

### 2.1.2 Endlocks and Windlocks

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

### 2.1.3 Bottom Bar

The curtain shall have a standard bottom bar consisting of two hot-dip galvanized steel angles for steel doors. A sensing edge shall be attached to the bottom bar of doors that are electric-power operated.

### 2.1.4 Guides

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

2.1.5 Barrel

The barrel shall be steel pipe or commercial welded steel tubing of proper diameter for the size of curtain. Deflection shall not exceed 2.5 mm per meter (0.03 inch per foot) of span. Ends of the barrel shall be closed with cast-iron or steel plugs, machined to fit the pipe.

2.1.6 Springs

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

2.1.7 Brackets

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

2.1.8 Hoods

Hoods shall be steel, with minimum bare metal thickness of 0.70 mm (24 gauge) (0.0209 inch), formed to fit contour of the end brackets, and shall be reinforced with steel rods, rolled beads, or flanges at top and bottom edges. Multiple segment and single piece hoods shall be provided with support brackets of the manufacturer's standard design as required for adequate support.

2.1.9 Weatherstripping

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

2.1.10 Slat Openings

2.1.11 Operation

Doors shall be operated by means of manual hand-chain with provision made for future installation of electric power.

2.1.11.1 Manual Push-Up Operation
*Omitted*

2.1.11.2 Manual Hand-Chain Operation

Operation shall be by means of a galvanized, endless chain operating over a sprocket and extending to within 900 mm (3 feet) of floor. Reduction shall be provided by use of roller chain and sprocket drive or suitable gearing, to reduce the pull required on hand chain to not over 156 N (35 pounds). Gears shall be high grade gray cast iron.

2.1.12 *Omitted*

2.1.13 Locking

Locking shall consist of interior slide bolts, suitable for padlock by others, for manual push-up doors with chain lock for emergency hand chain.

2.1.14 Finish

Steel slats and hoods shall be hot-dip galvanized G90 in accordance with ASTM A 653, and shall be treated for paint adhesion and shall receive a baked on prime coat baked on prime coat for field finishing. Finish coat shall be in accordance with Section 09900 PAINTING, GENERAL. The paint system shall withstand a minimum of 1,500 hours without blistering, bubbling, or rust. Surfaces other than slats, hood, and faying surfaces shall be cleaned and treated to assure maximum paint adherence and shall be given a factory dip or spray coat of rust inhibitive metallic oxide or synthetic resin primer. Color shall be brown.

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. Fire doors shall be installed in conformance with the requirements of NFPA 80 and the manufacturer's instructions.

-- End of Section --

SECTION 08520

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1980) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 101 (1993) Voluntary Specifications for Aluminum and Poly(Vinyl Chloride) (PVC) Prime Windows and Glass Doors

AAMA 603.8 (1992) Voluntary Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum

AAMA 605.2 (1992; Addenda Feb 1994) Voluntary Specification for High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels

AAMA 1503.1 (1988) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

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

ASTM E 547 (1993) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A39.1 (1991; A39.1a) Safety Requirements for Window Cleaning

INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (1994) Safety to Life from Fire in Buildings and Structures

SCREEN MANUFACTURERS ASSOCIATION (SMA)

SMA 1004 (1987) Aluminum Tubular Frame Screens for Windows

1.2 WINDOW PERFORMANCE

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

1.2.1 Structural Performance

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

1.2.2 Air Infiltration

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

1.2.3 Water Penetration

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

1.2.4 Thermal Performance

Thermal transmittance for thermally broken aluminum windows with insulating glass shall not exceed R-Value Class 0.59 m/W (R3.33 0.44 m k/Q (R2.5) when tested in accordance with AAMA 1503.1.

1.3 SUBMITTALS

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

SD-01 Data

Aluminum Windows; GA.

Manufacturer's descriptive data and catalog cut sheets.

SD-04 Drawings

Aluminum Windows; GA.

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

SD-06 Instructions

Aluminum Windows; FIO.

Manufacturer's preprinted installation instructions and cleaning instructions.

SD-09 Reports

Aluminum Windows; FIO.

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

SD-13 Certificates

Aluminum Windows; FIO.

Certificates stating that the aluminum windows are AAMA certified conforming to requirements of this section. Labels or markings permanently affixed to the window will be accepted in lieu of certificates.

SD-14 Samples

Aluminum Windows; FIO.

Manufacturer's standard color samples of the specified finishes.

1.4 QUALIFICATION

Window manufacturer shall specialize in designing and manufacturing the type of aluminum windows specified in this section, and shall have a minimum of ten (10) years of documented successful experience. Manufacturer shall have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.5 *OMITTED*

1.6 DELIVERY AND STORAGE

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

1.7 WARRANTY

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

PART 2 PRODUCTS

2.1 ALUMINUM WINDOW TYPES

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

2.1.1 *Omitted*
2.1.2 *Omitted*
2.1.3 *Omitted*

2.1.4 Fixed Windows

Aluminum fixed windows shall conform to AAMA 101 F-C25 type, non-operable glazed frame, complete with provisions for reglazing in the field.

## 2.2 WEATHERSTRIPPING

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

## 2.3 *OMITTED*

## 2.4 ACCESSORIES

### 2.4.1 Fasteners

Fastening devices shall be window manufacturer's standard design made from aluminum, non-magnetic stainless steel, cadmium-plated steel, nickel/chrome-plated steel or magnetic stainless steel in compliance with AAMA 101. Self-tapping sheet metal screws will not be acceptable for material thicker than 2 mm (1/16 inch).

### 2.4.2 Hardware

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

### 2.4.3 Window Anchors

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

## 2.5 GLASS AND GLAZING

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

## 2.6 FINISH

### 2.6.1 Anodized Aluminum Finish

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

### 2.6.2 *Omitted*
### 2.6.3 *Omitted*

### 2.6.4 Color

Color shall be in accordance with Section 09915 COLOR SCHEDULE.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Aluminum windows shall be installed in accordance with approved shop drawings and manufacturer's published instructions. Aluminum surfaces in contact with masonry, concrete, wood and dissimilar metals other than stainless steel, zinc, cadmium or small areas of white bronze, shall be protected from direct contact using protective materials recommended by AAMA 101. The completed window installation shall be watertight in accordance with Section 07920 JOINT SEALING. Glass and glazing shall be installed in accordance with requirements of this section and Section 08810 GLASS AND GLAZING.

## 3.2 ADJUSTMENTS AND CLEANING

### 3.2.1 Hardware Adjustments

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

### 3.2.2 Cleaning

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

-- End of Section --

SECTION 08700

DOOR HARDWARE

PART I GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

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. May 1994) Directory of Certified Exit Devices

BHMA A156.1 (1988) Butts and Hinges

BHMA A156.2 (1989) Bored and Pre assembled 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 A156.7 (1988) Template Hinge Dimensions

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

BHMA A156.13 (1994) Mortise Locks & Latches

BHMA A156.15 (1986) Closer Holder Release Device

BHMA A156.16 (1989) Auxiliary Hardware

BHMA A156.18 (1987) Materials and Finishes

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

BHMA Al 56.21 (1989) Threshold

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 Hardware

DHI-Al15.I (1994) Installation Guide for Doors and Hardware

DHI-A115-W (Varies) Wood Door Hardware Standards (Incl All-W1 thru Al15-W9)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1992) Fire Doors and Windows

NFPA 101 (1994) Safety to Life from Fire in Buildings and Structures

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The form 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 device, closers, after approval of the d6tail drawings, and not later than 10 days prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit process and sources of submittal.

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; corresponding reference standard type number or function number from manufacturer's catalog if not covered by ANSI or BHMA; and list of abbreviations and template numbers.

Keying Schedule; GA.

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

SD-13 Certificates

Hardware and Accessories; FIO

The material supplier's or hardware manufacturer's certificates of compliance stating that the supplied material or hardware item meets specified requirements. Each certificate shall be signed by an official authorized to certify ' in behalf ' of material supplier or product manufacturer and shall. identify quantity and date or dates of shipment or delivery to which the certificates apply. A statement that the proposed hardware items appear in

BHMA-01, BHMA-02 and BHMA-03 directories of certified products may be submitted in lieu of certificates. A separate Certificate of Compliance from the manufacturer attesting that hardware items conform to the "Buy American Act" shall be included, NAFTA and EEC materials are allowed under the Buy American Act.

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 manufacture, 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 1 year period shall be provided.

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 drawing.

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 manufacture, 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 Al56.7.

2.3 HINGES

Hinges shall conform to BHMA Al56.1. Hinges used on metal doors and frames shall also conform to BHMA A156.7. Except as otherwise specified hinge sizes shall conform to the hinges 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

non-removable by means such as a set screw in the barrel, or safety stud, when the door is the closed position.

2.3.2 Contractor's Option

Hinges with antifriction bearings may be furnished in lieu of ball bearing hinges, except where prohibited for fire doors by the requirements of NFPA 80.

2.3.3 Pivot Hinges

Pivot hinges shall conform to BHMA A156.4.

2.4 LOCKS AND LATCHES

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

2.4.1 Mortise Locks and Latchsets

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform to BHMA Al56.13, operational Grade 1. Mortise type locks and latches for doors 44mm (1-3/4 inches) thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts.

2.4.2 Bored Lock and Latchsets

Bored lock, latchsets, and strikes shall be series 4000 and shall conform to BHMA A156.2, Grade 1. Bored type locks and latches for doors 35mm. (1-3/8 inches) thick and over shall have adjustable bevel fronts or otherwise conform to the shape-of the door.

2.4.3 Omitted

2.4.4 Auxiliary Locks and Associated Products

Bored and mortise dead locks and dead latches, narrow style dead locks and dead latches, rim latches, dead latches, and dead bolts, shall conform to BHMA Al56.5. Strike boxes shall be furnished with dead bolt and latch strikes for Grade 1.

2.4.5 Lock Cylinders (Mortise, Rim and Bored)

Lock cylinders shall comply with BHMA Al56.5. Lock cylinder shall have not less than six pins. Cylinders shall have key removable type cores. A master keying system shall be provided for each building. Construction interchangeable core shall be provided. All locksets, exit devices, and padlocks shall accept same interchangeable cores.

2.4.6 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.

2.4.7 Padlocks

Padlocks shall conform to ASTM F 883. Straps, tee hinges, and hasps shall conform to BHMA Al56.20

2.4.8 Omitted

2.4.9 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 Al56.2 or BHMA Al56.13, knobs, lever handles, roses, and escutcheons shall be 1.27 mm (0.050 inch) thick, if unreinforced. If reinforced, the outer shell shall be 0.89 mm (0.035 inch) thick and the combined thickness shall be 1.78 mm (0.070 inch) except that knob shanks shall be 1.52mm (0.060 inch) thick. Knob diameter shall be 54 to 57 mm (2-1/8 to 2-1/4 inches). Lever handles shall be minimum 100m (4 inches) long of plain design with ends returned to no more than 10 mm (1 /2 inch ) from the door face.

2.5 EXIT DEVICES AND EXIT DEVICE ACCESSORIES

Exit device and exit device accessories shall conform to BHMA A156.6, Grade 1.

2.5.1 Exit Device and Auxiliary Items

Trim shall be of wrought construction and commercial plain design with straight, beveled or smoothly rounded sides, coroners, and edges. Adjustable strikes shall be provided for rim type and vertical rod devices. Open back strike 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 may be provided in lieu of conventional crossbars and arms. Escutcheons shall be cut to suit cylinders and operating trim.

2.6 OMITTED

2.7 KEYING

Locks shall be keyed in sets or subsets as scheduled. Locks shall be furnished with the manufacturer's standard construction key system. Permanent keys shall be sent by the lock manufacturer directly to the Contracting Officer by registered mail or other approved means. 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: | 2 keys each set. |
| Construction keys: | 10 total. |
| Blank keys: | 250 total. |
| Control keys | 2 |

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

2.8 DOOR CLOSING DEVICE

Door closing device shall conform to BHMA Al56.4, Grad 1. Closing devices shall be products of one manufacturer for each type specified.

2.8. 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, size 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.

2.9 DOOR CONTROLS - OVERHEAD HOLDERS

Door controls - overhead holders shall conform to BHMA Al56.8.

2.10 OMITTED
2.11 OMITTED

2.12 ARCHITECTURAL DOOR TRIM

2.12. 1 Door Protection Plates

2.12.1.1 Armor Plates

Armor plates shall be Type JI01 stainless steel, 900 mm (36 inches) in height, and 50 mm (2 inches) less in width than the width of the door for single doors and 25 mm (1 inch) less for pairs of doors. Edges of metal plates hall be beveled. Where the door had a louver panel, the armor plate shall be omitted if top of louver frame is more than 500 mm (20 inches) above the bottom of the door.

2.12.1.2 Kick Plates

Kick plates shall be Type J102 stainless steel. Width of plates shall be 50 mm (2 inches) less than door width for single doors and 25 mm (1 inch) less for pairs of doors. Height shall be 400 mm (16 inches), except where the bottom rail is less than 400 mm (16 inches) the plate shall extend to within 13 mm (1/2 inch) of the panel mold or glass bead. Edges of metal plates shall be beveled.

2.12.2 Omitted

2.12.3 Push Plates

2.12.3.1 Omitted

2.12.3.2 Flat Plates

Flat plates shall be Type J304 3.2 mm (1/8 inch) stainless steel size 150 mm by 400 mm (6 inches by 16 inches). Edges of metal plates shall be beveled.

2.12.4 Door Pulls and Push/Pull Units

2.12.4.1 Arm Pulls

Arm pulls shall be Category J400, double base, stainless steel.

2.12.4.2 Omitted

2.12.4.3 Door Pulls

Door pulls shall be Category J400 stainless steel of plain modem design. Pulls for hollow metal, mineral core wood or kalamein doors shall be Type J40 thru-bolted to Type J304 flat push plates.

2.12.5 Push and Pull Bars

Push and pull bars shall be Category J500, stainless steel. Edge of mounting plates shall be beveled.

## 2.13 AUXILIARY HARDWARE

Auxiliary hardware, consisting of door holders, and door stops, shall conform to BHMA A156.16. Lever extension flush bolts shall be Type L14081. Dustproof strikes shall be Type L04011 for doors that are not fire rated. Dustproof strikes shall be Type L04021 for fire rated doors.

## 2.14 MISCELLANEOUS

### 2.14.1 Omitted

### 2.14.2 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. Latching thresholds shall conform to BHMA Al56.3, Type 26, and of such height that the bottom of the door shall be 3 mm (1/8 inch) over the tread of the threshold and 3 mm (1/8 inch) below the top of the stop.

Where required, thresholds shall be modified to receive projecting bolts of flush bolts or exit devices. Threshold for doors accessible to the handicapped shall be beveled with slops not exceeding 1:2 and with heights not exceeding 13 mm (1/2 inch). Air leakage rate of weatherstripping shall not exceed 0.775 liters per second per lineal meter (0.5 cubic feet per minute per lineal foot) of crack when tested in. accordance with ASTM E 283 at standard test conditions.

### 2.14.3 Omitted

### 2.12.4 Aluminum Housed Type Weatherseals

#### 2.14.4.1 Weatherseals for Head and Jambs

Weatherseals for head and jambs shall be extruded aluminum retainers with not less than 1.78 mm (0.07 inch wall thickness with industrial / commercial grade neoprene, silicone rubber or polyurethane inserts. Aluminum shall be dark bronze anodized. Seals shall remain functional through all weather and temperature conditions. Air leakage rate of weatherstripping shall not exceed 0.775 liters per seconds per lineal meter (0.5 cubic feet per minute per lineal foot) of crack when tested in accordance with ASTM E 283 at standard conditions.

#### 2.14.4.2 Door Bottom Seals

Exterior door bottom seals shall be extruded aluminum retainers with not less than 1.78 mm (0.07 inch) wall thickness with industrial / commercial grade neoprene, silicone rubber or polyurethane inserts. Aluminum shall be anodized. Seals shall be designed for the intended purpose and shall provide an effective seal with the threshold to exclude light, drafts, dirt, water and insect entry.

### 2.14.5 Omitted

### 2.14.6 Key Control Storage System

Key control storage system shall conform to BHMA Al56.5, Type E83 52, capacity as required, and shall be properly labeled for key identification. Set up, identification labeling and location of the key control storage shall be as directed by the Contracting Officer's Representative.

2.15 FASTENINGS

Fastenings of proper type, size, quantity, and finish shall be supplied with each article of hardware. Machine screw 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.

2.16 FINISHES

Unless otherwise specified, finishes shall conform to those identified in BHMA Al56.18. Where painting of primed surfaces -as required, painting is specified in Section 09900 PAINTING, GENERAL.

2.17 HARDWARE FOR FIRE DOORS

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

PART 3 EXECUTION

3.1 APPLICATION

Hardware shall be located in accordance with DHI-04 and DHI-05. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI A115-W. Door control devices for exterior doors such as closers and holders, shall normally attach to doors with thru bolts and nuts or sex bolts. Electric hardware items and access control devices shall be installed in accordance with manufacturer's printed installation procedures.

3.1.1 Hardware for Fire 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 lockset, 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.

3.1.2 Door-Closing Devices

Door-closing device 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 System

Key control storage system shall be furnished to the Contracting Officer.

3.1.4 Kick Plates

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

3.1.5 Auxiliary Plates

Lever extension flush bolts shall be installed at the top and bottom of the inactive leaf of pair 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 (12 inches). Exterior thresholds shall be installed in a bed of sealant with expansion anchors and stainless steel screws, except that bronze or anodized bronze thresholds shall be installed with expansion anchors with brass screws. Minimum screw size shall be No. 10 length, dependent on job conditions, with a minimum of 19 mm (3/4 inch) thread engagement into the floor or anchoring device used.

3.1.7 Omitted

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 finished painted. Screw spacing shall be as recommended by manufacturer.

3.2 OMITTED

3.3 HARDWARE SETS

HARDWARE SET AL-1:

DOORS: 100,101,102,120

EACH DOOR TO HAVE:

| | | |
|---|---|---|
| 1 | SET PIVOTS | CO7162 X C0 7321 X 626 |
| 1 | EXIT DEVICE | TYPE 4 -FUNC 08 (LEVER) -GRADE 1 X 630 |
| 1 | CYLINDER | E09211/E09221 AS REQUIRED X 626 |
| 1 | CLOSER | C02021-PT4G X MTG. BRA AS REQ'D X 689 |
| 1 | THRESHOLD | J31200 X WIDTH AS REQ'D |
| 1 | GASKETING | BY DOOR/FRAME MANUFACTURER |

HARDWARE SET # AL2

DOORS: 121,134,143,176

| | | |
|---|---|---|
| 1 | SET PIVOTS | C07172 X C07321 X 626 |
| 1 | PUSH BAR | J501 X 630 |
| 1 | PULL | J402 X 630 |
| 1 | CLOSER | C02021-PT4G X MTG. BRA AS REQ'D X 689 |

HARDWARE SET # 1

DOORS: 119

EACH PAIR TO HAVE:

| | | |
|---|---|---|
| 6 | HINGES | A511 X 630 X |
| 1 | EXIT DEVICE | TYPE 2 FUNC 08 (LEVER) GRADE 1 X 630 |
| 1 | EXIT DEVICE | TYPE 2 FUNC 02 (LEVER) GRADE 1 X 630 |
| 1 | CYLINDER | E09211/EO9221 AS REQ'D X 626 |
| 2 | CLOSERS | C02021-PT4G X 689 |
| 1 | KICKPLATES | J102 X 630 |
| 1 | THRESHOLD | J32100 X WIDTH AS REQ'D |
| 2 | DOOR SWEEPS | ALUM/W INSERTS AS SPECIFIED |

| | | |
|---|---|---|
| 1 | GASKETING | ALUM RETAINER W/INSERTS AS SPECIFIED |

HARDWARE SET # 2

DOORS # 106,107,110,112

EACH TO HAVE:

| | | |
|---|---|---|
| 3 | HINGES | A511 X 630 X |
| 1 | EXIT DEVICE | TYPE 1 FUNC 03 GRADE 1 X 630 |
| 1 | CYLINDER | EO9211/EO99221 AS REQ'D X 626 |
| 1 | CLOSER | CO2021 W/PT4G X 689 |
| 1 | KICKPLATE | J102 X 630 |
| 1 | THRESHOLD | J32100 X  WIDTH AS REQ'D |
| 1 | DOOR SWEEP | ALUM W/INSERTS AS SPECIFIED |
| 1 | SET GASKETING | ALUM RETAINER W/INSERTS AS SPECIFIED |

HARDWARE SET # 3

DOORS: 104,109,111,113,114,115

EACH PAIR TO HAVE:

| | | |
|---|---|---|
| 6 | HINGES | A5112 X 63 X |
| 2 | FLUSH BOLTS | l04081 X 626 |
| 1 | LOCKSET | F07, GRADE 1 X 630 |
| 2 | OVERHEAD HOLDER | C12511 X 626 |
| 1 | THRESHOLD | J32100 X  WIDTH AS REQ'D |
| 2 | DOOR SWEEPS | ALUM RETAINER W/INSERTS AS SPECIFIED |
| 1 | SET GASKETING | ALUM RETAINER W/INSERTS AS SPECIFIED |

HARDWARE SET #4

DOORS:  4

EACH DOOR TO HAVE:

| | | |
|---|---|---|
| 3 | HINGES | A5112 X 630 |
| 1 | LOCKSET | F07, GRADE 1 X 630 |
| 1 | OVERHEAD HOLDER | C12511 X 626 |
| 1 | THRESHOLD | J32100 X  WIDTH AS REQ'D |
| 1 | DOOR SWEEP | ALUM W/INSERTS AS SPECIFIED |
| 1 | SET GATHERING | ALUM RETAINER W/INSERTS SPECIFIED |

HARDWARE SET #5

DOORS:  116, 187, 188, 189, 190, 191, 192, 193

EACH TO HAVE:

| | | |
|---|---|---|
| 1 | CYLINDER | EO9211 X 626 |

NOTE: BALANCE OF HARDWARE BY DOOR / GATE SUPPLIER.

HARDWARE SET #6

DOORS: 169,195

EACH TO HAVE:

NOTE: ALL HARDWATE BY VAULT SUPPLIER

HARDWARE SET # 7

DOORS: 103

EACH TO HAVE:

| | | |
|---|---|---|
| 3 | HINGES | A5111 X 630 |
| 1 | LOCKSET | F06, GRADE 1 X 630 |
| 1 | CLOSER | CO2021 X PT4D |
| 1 | KICKPLATE | J102 X 630 |
| 1 | FLOOR STOP | l02131 X 626 |
| 1 | THRESHOLD | J32100 X WIDTH AS REQ'D |
| 1 | DOOR SWEEP | ALUM W/INSERTS AS SPECIFIED |
| 1 | GASKETING | ALUM RETAINERS W/INSERTS AS SPECIFIED |

HARDWARE SET # 8

DOORS: 146

EACH TO HAVE:

| | | |
|---|---|---|
| 3 | HINGES | A5111 X 630 |
| ~~1~~ | ~~PUSH PLATE~~ | ~~J407 X 630~~ |
| ~~1~~ | ~~PULLPLATE~~ | ~~J304 X 630~~ |
| 1 | CLOSER | C02021 X 689 X PT4D |
| 1 | KICKPLATE | J102 X 630 |
| 1 | MOP PLATE | J103 X 630 |
| 1 | FLOOR STOP | L02131 X 626 |
| 3 | SILENCERS | L03011 |
| 1 | Lockset | The lockset shall be a touch code electronic lock equal to Yale Security Inc., No. 2677 with all required electrical connections for complete operatiions. |

*3

HARDWARE SET # 9

DOORS: 128,129,147,149,153,155,157,158

EACH TO HAVE:

| | | |
|---|---|---|
| 3 | HINGES | A5112 X 630 |
| 1 | PRIVACY SET | F76, GRADE 1 X 626 |
| 1 | OVERHEAD STOP | C15541 X 626 |
| 3 | SILENCERS | L03011 |

HARDWARE SET # 10

DOORS: 126,127,132,138,139,145,151,152,181,185,194

EACH TO HAVE:

| | | |
|---|---|---|
| 3 | HINGES | A8112 X 652 |
| 1 | LOCKSET | F86, GRADE 1 X 626 |
| 1 | FLOOR STOP | L02141 X 626 |
| 3 | SILENCERS | L03011 |

HARDWARE SET # 11

DOORS: 130,150,154,159,161,182

EACH DOOR TO HAVE:

| | | |
|---|---|---|
| 3 | HINGES | A8112 X 652 |
| 1 | LOCKSET | F86, GRADE 1 X 626 |
| 1 | OVERHEAD STOP | C15541 X 626 |
| 3 | SILENCERS | L030311 |

HARDWARE SET # 12

DOORS: 123,135,142,163,173,178,183

EACH DOOR TO HAVE:

| | | |
|---|---|---|
| 3 | HINGES | A8111 X 652 |
| 1 | LOCKSET | F84, GRADE 1 X 626 |
| 1 | CLOSER | C02021 X 689 X PT4D |
| 1 | KICKPLATE | J102 X 630 |
| 1 | WALL BUMPER | L02101 X 630 |
| 3 | SILENCERS | L03011 |

HARDWARE SET # 13

DOORS: 122,133,144,175

EACH DOOR TO HAVE:

| | | |
|---|---|---|
| 3 | HINGES | A8112 X 652 |
| 1 | PASSAGE SET | F82, GRADE 1 X 626 |
| 1 | FLOOR STOP | L02041 X 626 |
| 3 | SILENCERS | L03011 |

HARDWARE SET # 14

DOORS: 124,125,136,137,140,141,162,164,165,166,167,168,170,171,172,179,180

EACH DOOR TO HAVE:

| | | |
|---|---|---|
| 3 | HINGES | A8112 X 652 |
| 1 | LOCKSET | F82, GRADE 1 X 626 |
| 1 | WALL BUMPER | L02251 X 630 |
| 3 | SILENCERS | L03011 |

HARDWARE SET # 15

DOORS: 174, 184

EACH DOOR TO HAVE:

| | | |
|---|---|---|
| 3 | HINGES | A8111 X 652 |
| 1 | PASSAGESET | F82, GRADE I X 626 |
| 1 | CLOSER | C02021 X 689 X PT4D |
| I | KICKPLATE | J102 X 630 |
| 1 | WALL BUMPER | L02101 X630 |
| 3 | SILENCERS | L03011 |

HARDWARE SET # 16

DOORS: 131, 148, 156, 160

EACH PAIR TO HAVE:

| | | |
|---|---|---|
| 6 | HINGES | A8112 X 652 |
| 2 | FLUSHBOLTS | l04081 X 626 |
| 1 | LOCKSET | F86, GRADE 1 X 626 |
| 2 | OVERHEAD STOPS | C15541 X 626 |
| 2 | SILENCERS | L03011 |

End of Section

SECTION 08810

GLASS AND GLAZING

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509 (1994) Elastomeric Cellular Preformed Gasket and Sealing Material

ASTM C 669 (1994) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash

ASTM C 864 (1993) Dense Elastomeric Seal Gaskets, Setting Blocks, and Spacers

ASTM C 920 (1987) Elastomeric Joint Sealants

ASTM C 1036 (1991) Flat Glass

ASTM C 1048 (1992) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

ASTM C 1172 (1991) Laminated Architectural Flat Glass

ASTM D 395 (1989; R 1994) Rubber Property - Compression Set

ASTM E 152 (1981a) Fire Tests of Door Assemblies

ASTM E 163 (1984) Fire Tests of Window Assemblies

ASTM E 773 (1988) Seal Durability of Sealed Insulating Glass Units

ASTM E 774 (1992) Sealed Insulating Glass Units

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (1993) Minimum Design Loads for Buildings and Other Structures

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1201 Safety Standard for Architectural Glazing Materials

COMMERCIAL ITEM DESCRIPTION (CID)

CID A-A-378 (Basic) Putty Linseed Oil Type (for Wood Sash Glazing)

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA-01 (1990) Glazing Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1992) Fire Doors and Windows

1.2 SUBMITTALS

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

SD-01 Data

Glass; FIO. Glazing Accessories; FIO.

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

SD-04 Drawings

Glazing Materials and Accessories; FIO.

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

SD-13 Certificates

Glass; FIO.

Certificates stating that the glass meets the specified requirements. Labels or marking affixed to the glass will be accepted in lieu of certificates.

SD-14 Samples

Glass; FIO.

Two 203 by 254 mm (8- by 10-inch) samples of each of the following: Low “E” insulating glass units, single pane low “E” glass and temp glass-clear.

1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work.

1.4 DELIVERY, STORAGE AND HANDLING

Glazing compounds shall be delivered to the site in the manufacturer's unopened containers. Glass shall be stored indoors in a safe, well ventilated dry location in accordance with manufacturer's instructions, and shall not be unpacked until needed for installation. Glass shall not be stored on site over 1 month.

1.5 PROJECT/SITE CONDITIONS

Glazing work shall not be started until outdoor temperature is above 5 degrees C (40 degrees F) and rising, unless procedures recommended by glass manufacturer and approved by Contracting Officer are made to warm the glass and rabbet surfaces. Ventilation shall be provided to prevent condensation of moisture on glazing work during installation. Glazing work shall not be performed during damp or raining weather.

1.6 WARRANTY

1.6.1 Insulating Glass

Manufacturer shall warrant the insulating glass to be free of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal for a period of 10 years from Date of Substantial Completion. Warranty shall be signed by manufacturer.

PART 2 PRODUCTS

2.1 FLOAT GLASS

2.1.1 Clear Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - clear, Quality q3 - glazing select, 79 percent light transmittance, 83 percent shading coefficient, conforming to ASTM C 1036.

2.3 INSULATING GLASS

Insulating glass shall be Class A preassembled units of dual-seal construction consisting of lites of glass separated by an aluminum spacer and dehydrated space conforming to ASTM E 773 and ASTM E 774. Aluminum spacer shall be roll-formed, with bent or tightly soldered joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone. Glass types shall be as follows:

2.3.1 *Omitted*
2.3.2 *Omitted*
2.3.3 *Omitted*

2.3.4 Low-E Insulating Glass

Interior and exterior glass panes for Low-E insulating units shall be Type I annealed flat glass, Class 2-tinted with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C 1036. Glass performance shall be K-Value/Winter Nighttime .31, (R-Value/Winter Nighttime 3.2,) shading coefficient .29. Color shall be bronze as shown in Section 09915 COLOR SCHEDULE.

2.4 *OMITTED*

2.4.1 *Omitted*

2.4.2 Low-Emissivity (Low-E) Glass

Low-emissivity (Low-E) glass shall be Type I annealed flat type, Class 2-tinted with low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select. Glass performance shall be K-Value/Winter Nighttime 1.02 (R-Value/Winter Nighttime .98), shading coefficient .35. Color shall be bronze as shown in Section 09915 COLOR SCHEDULE.

2.5 HEAT-TREATED GLASS

Heat-treated glass shall conform to the following requirements.

2.5.1 Tempered Glass

Tempered glass shall be kind FT fully tempered transparent flat type, Class 2-tinted, Condition A uncoated surface, Quality q3 - glazing select, 11 percent light transmittance, 35 percent shading coefficient conforming to ASTM C 1048. Color shall be bronze as shown in Section 09915 COLOR SCHEDULE.

2.6 *OMITTED*
2.7 *OMITTED*

2.8 MIRRORS

2.8.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear, Glazing Quality q1 6 mm (1/4 inch) thick conforming to ASTM C 1036. Glass color shall be clear. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 6 mm (1/4 inch) thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint , and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.8.2 *Omitted*

2.8.3 Mirror Accessories

2.8.3.1 Mastic

Mastic for setting mirrors shall be a polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

2.8.3.2 Mirror Frames

Mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 32 by 6 by 6 mm (1-1/4 by 1/4 by 1/4 inch) continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

2.9 *OMITTED*

2.10 GLAZING ACCESSORIES

2.10.1 Preformed Tape

Preformed tape shall be elastomeric rubber extruded into a ribbon of a width and thickness suitable for specific application. Tape shall be of type which will remain resilient, have excellent adhesion, and be chemically compatible to glass, metal, or wood.

2.10.2 Sealant

Sealant shall be elastomeric conforming to ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks,

preformed sealing tape and sealants used in manufacturing insulating glass. Color of sealant shall be as selected.

2.10.3 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

2.10.3.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C 509, Type 2, Option 1.

2.10.3.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C 864, Option 1, Shore A durometer between 65 and 75.

2.10.3.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

2.10.4 Putty and Glazing Compound

Glazing compound shall conform to ASTM C 669 for face-glazing metal sash. Putty shall be linseed oil type conforming to CID A-A-378 for face-glazing primed wood sash. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

2.10.5 Setting and Edge Blocking

Neoprene setting blocks shall be dense extruded type conforming to ASTM D 395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (plus or minus 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

Openings and framing systems scheduled to receive glass shall be examined for compliance with approved shop drawings, GANA-01 and glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaces and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

3.2 INSTALLATION

Glass and glazing work shall be performed in accordance with approved shop drawings, GANA-01, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Wired glass shall be installed in accordance with NFPA 80. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

## 3.3 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

## 3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

-- End of Section --

SECTION 09250

GYPSUM WALLBOARD

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 580 | (1991b) Stainless and Heat Resisting Steel Wire |
| ASTM A 853 | (1991) Steel Wire, Carbon, for General Use |
| ASTM C 36 | (1993) Gypsum Wallboard |
| ASTM C 79 | (1992) Gypsum Sheathing Board |
| ASTM C 442 | (1992) Gypsum Backing Board and Coreboard |
| ASTM C 475 | (1989) Joint Compound and Joint Tape for Finishing Gypsum Board |
| ASTM C 514 | (1990) Nails for the Application of Gypsum Board |
| ASTM C 557 | (1993) Adhesive for Fastening Gypsum Wallboard to Wood Framing |
| ASTM C 630 | (1993) Water-Resistant Gypsum Backing Board |
| ASTM C 645 | (1992) Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board |
| ASTM C 754 | (1988) Installation of Steel Framing Members to Receive Screw-Attached Gypsum |
| ASTM C 840 | (1988) Application and Finishing of Gypsum Board |
| ASTM C 931 | (1992) Exterior Gypsum Soffit Board |
| ASTM C 955 | (1993) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Track), and Bracing or Bridging for Screw Application of Gypsum Board and Metal Plaster Bases |
| ASTM C 960 | (1991) Predecorated 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 | (1993) Specification Tested Products Guide |

FEDERAL SPECIFICATION (FS)

FS QQ-N-281 (Rev D; Am 2) Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings and Structural and Special Shaped Sections

GYPSUM ASSOCIATION (GA)

GA 600 (1992) Fire Resistance Design Manual

UNDERWRITERS LABORATORIES (UL)

UL-05 (1993; 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.

1.2.2 Pressurized Enclosures

Pressurized fire-rated gypsum board enclosures shall allow the mechanical and electrical life-safety systems to operate in accordance with the design intent. Air pressure within elevator shaft shall be 360 Pa (7.5 psf). Air pressure within stair shaft shall be 240 Pa (5.0 psf). Maximum midspan deflection shall be L/360.

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.

1.4 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 10 (ten) years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 5 (five) 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 job site.

## 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 (40 degrees F) shall be maintained. During the application of gypsum board with adhesive, a room temperature of not less than 10 degrees C (50 degrees F) 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 NONLOADBEARING STUD WALLS

### 2.1.1 Studs

Studs for nonloadbearing walls shall conform to ASTM C 645. Studs shall be prefabricated 1.214 mm thick (18-gauge) steel, C-shaped, punched web for utility access, G60 hot-dip galvanized after fabrication, or truss-designed studs fabricated of 1.519 mm thick (16-gauge) steel angles with a single No. 7 gauge rod forming an open-web truss-like pattern between flanges with all points contact welded.

### 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 (7/8 inch) flanges, unpunched web, gauge to match studs, G60 hot-dip galvanized after fabrication.

## 2.3 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 (16 gauge) cold-rolled steel, hot-dipped galvanized after fabrication, 38 by 19 mm (1-1/2 x 3/4 inch) deep. Furring members shall be formed from cold-rolled steel, hot-dip galvanized after fabrication, 19 mm high by 19 mm deep (3/4 inch high x 3/4 inch deep).

## 2.4 GYPSUM BOARD

Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length.

### 2.4.1 Standard Gypsum Board

Regular gypsum board shall conform to ASTM C 36, and shall be 1,200 mm (48 inches) wide.

### 2.4.2 Fire-Rated Gypsum Board

Fire-rated gypsum board shall conform to ASTM C 36, and shall be Type X, 1,200 mm (48 inches) wide.

2.4.3 Water-Resistant Gypsum Board

Water-resistant gypsum board shall conform to ASTM C 630, regular and Type X, with water-resistant paper faces, paintable surfaces, and shall be 1,200 mm (48-inch) width and maximum permissible length.

2.4.4 Gypsum Backing Board

Gypsum backing board shall conform to ASTM C 442, regular and Type X, 1,200 mm (48 inches) wide. Backing board shall have aluminum foil vapor retarder laminated to back surface.

2.4.5 Foil-Backed Gypsum Board

Foil-backed gypsum board shall conform to ASTM C 36, regular and Type X, 1,200 mm (48 inches) wide. Gypsum board shall have aluminum foil vapor retarder laminated to back surface.

2.4.6 *Omitted*
2.4.7 *Omitted*

2.4.8 Exterior Gypsum Soffit Board

Exterior gypsum soffit board shall conform to ASTM C 931, regular, 1,200 mm (48 inches) wide.

2.5 ACCESSORIES

2.5.1 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.

2.5.2 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.

2.5.3 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.

2.5.4 Joint Tape

Joint tape shall conform to ASTM C 475 and shall be as recommended by gypsum board manufacturer.

2.5.5 Nails

Nails shall conform to ASTM C 514. Nails shall be hard-drawn low or medium-low carbon steel, suitable for intended use. Special nails for predecorated gypsum board shall be as recommended by predecorated gypsum board manufacturer.

2.5.6 Screws

Screws shall conform to ASTM C 1002. Screws shall be self-drilling and self-tapping steel, Type S for wood or light-gauge steel framing and Type W for wood framing.

2.5.7 Adhesives

Adhesives shall conform to ASTM C 557. Adhesives shall be formulated to bond gypsum board to wood framing members. For securing gypsum board to metal framing, adhesive shall be as recommended by gypsum board manufacturer.

2.5.8 Hangers

Suspended ceiling runner channel hangers shall be soft, annealed steel wire not less than 4 mm (0.1620 inch) nominal diameter, conforming to ASTM A 853 or flat iron or steel straps, at least 2 by 22 mm (3/32 by 7/8 inch) size, coated with zinc, cadmium, or rust-inhibiting paint as shown on drawings.

2.5.9 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 FS QQ-N-281, Class A or B, 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.

2.5.9.1 Tie Wire

Tie wire for constructing partitions and vertical furring, for securing metal lath to supports, and for lacing shall be not less than 1.2 mm (0.0475 inch) diameter. Tie wire for other applications shall be not less than 1.6 mm (0.0625 inch) diameter.

2.5.9.2 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 (1/8 inch) thick or shall be hairpin clip, formed of wire not less than 0.4 mm (0.01620 inch) 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.

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

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 (30 inches) 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 placed back-to-back shall be used for framing solid-core doors, doors over 900 mm (3 feet) wide and extra-heavy doors such as X-ray room doors.

### 3.1.2 Wall Control Joints

Control joints for expansion and contraction shall be constructed with double studs installed 13 mm (1/2 inch) apart in interior walls or wall furrings where indicated on drawings, but shall not exceed 9 mm (30 feet) between control joints. 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 SHAFT WALL FRAMING

The shaft wall system shall be reinforced in accordance with the system manufacturer's published instructions. Bucks, anchors, blocking and other items placed in or behind shaft wall framing shall be coordinated with electrical and mechanical work. Fireproofing materials which are damaged or removed during shaft wall construction shall be patched or replaced.

## 3.3 SUSPENDED CEILING FRAMING

Suspended ceiling system framing shall be installed in accordance with ASTM C 754.

### 3.3.1 Hangers

Hangers shall be spaced not more than 1,200 mm (48 inches) along runner channels and 900 mm (36 inches) in the other direction or 1,050 mm (42 inches) in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other work. Hangers at ends of runner channels shall be located not more than 150 mm (6 inches) 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.

### 3.3.2 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 (6 inches) of the paralleling wall to support the ends of cross furring. Main runners shall not come in contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped 300 mm (12 inches) with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around the channels.

### 3.3.3 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 (2 inches) of parallel walls and beams, and shall be cut 13 mm (1/2 inch) short of abutting walls.

### 3.3.4 Ceiling Openings

Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than 38 mm (1-1/2 inch) main runner channels and vertically installed suspension wires or straps shall be located to provide at least the minimum support specified herein for furring and wallboard attachment. Intermediate structural members not a part of the structural system, shall be provided for attachment or suspension of support members.

### 3.3.5 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.

### 3.3.6 Control Joints

Control joints for expansion and contraction shall be located where indicated on drawings, and shall not exceed 230 square meters (2,500 square feet) in area nor more than 15 m (50 feet) in either direction.

## 3.4 APPLICATION OF GYPSUM BOARD

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.

### 3.4.1 Two-Ply Gypsum Board

Second layer of gypsum board shall be applied perpendicular to first layer with joints staggered and secured with mechanical fasteners.

### 3.4.2 Foil-Backed Gypsum Board

Foil-backed gypsum board shall be placed with reflective surface against framing members.

### 3.4.3 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.

## 3.5 TAPING AND FINISHING

Gypsum board taping and finishing shall be performed in accordance with ASTM C 840. Boards shall be kept free of dirt, oil and other foreign matter that could cause a lack of bond. Screw heads, dents, gouges, and cut-outs shall be filled with joint compound and sanded. Accessories at exposed joints, edges, corners, openings, and similar locations shall be taped, floated with joint compound, and sanded to produce surfaces ready for gypsum board finishes.

## 3.6 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.

## 3.7 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum board smooth, uniform in appearance, and ready to receive finish as specified.

-- End of Section --

SECTION 09310

CERAMIC TILE

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

| | |
|---|---|
| ANSI A108.1A | (1992) Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar |
| ANSI A108.1B | (1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar |
| ANSI A108.4 | (1992) Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive |
| ANSI A108.5 | (1992) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar |
| ANSI A108.6 | (1992) Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy |
| ANSI A108.7 | (1992) Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar |
| ANSI A108.8 | (1992) Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout |
| ANSI A108.10 | (1992) Installation of Grout in Tilework |
| ANSI A108.11 | (1992) Interior Installation of Cementitious Backup Units |
| ANSI A118.1 | (1992) Dry-Set Portland Cement Mortar |
| ANSI A118.2 | (1992) Conductive Dry-Set Portland Cement Mortar |
| ANSI A118.3 | (1992) Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive |
| ANSI A118.4 | (1992) Latex-Portland Cement Mortar |
| ANSI A118.5 | (1992) Chemical Resistant Furan Mortars and Grouts for Tile |
| ANSI A118.6 | (1992) Ceramic Tile Grouts |
| ANSI A118.9 | (1992) Test Methods and Specifications for Cementitious Backer Units |
| ANSI A136.1 | (1992) Organic Adhesives for Installation of Ceramic Tile |
| ANSI A137.1 | (1988) Ceramic Tile |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185 (1990a) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM C 33 (1992a) Concrete Aggregates

ASTM C 144 (1993) Aggregate for Masonry Mortar

ASTM C 150 (1992) Portland Cement

ASTM C 206 (1984; R 1992) Finishing Hydrated Lime

ASTM C 207 (1991; R 1992) Hydrated Lime for Masonry Purposes

ASTM C 241 (1990) Abrasion Resistance of Stone Subjected to Foot Traffic

ASTM C 373 (1988) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products

ASTM C 648 (1984; R 1989) Breaking Strength of Ceramic Tile

ASTM C 847 (1988; R 1992) Metal Lath

ASTM C 1026 (1987; R 1992) Measuring Frost Resistance of Ceramic Tile to Freeze-Thaw Cycling

ASTM C 1027 (1984; R 1990) Determining Visible Abrasion Resistance of Glazed Ceramic Tile

ASTM C 1028 (1989) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

MARBLE INSTITUTE OF AMERICA (MIA)

MIA-01 (1991) Design Manual IV Dimensional Stone

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 99 (1993) Health Care Facilities

TILE COUNCIL OF AMERICA (TCA)

TCA-01 (1994) Handbook for Ceramic Tile Installation

1.2 SUBMITTALS

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

SD-01 Data

Tile; FIO. Setting-Bed; FIO. Mortar, Grout, and Adhesive; FIO.

Manufacturer's catalog data.

SD-06 Instructions

Tile; FIO. Mortar and Grout; FIO.

Manufacturers preprinted installation and cleaning instructions.

SD-13 Certificates

Tile; FIO. Mortar, Grout, and Adhesive; FIO.

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

SD-14 Samples

Tile; FIO. Accessories; FIO. Marble Thresholds; FIO.

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

## 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover.

## 1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 10 degrees C (50 degrees F) and rising. Temperature shall be maintained above 10 degrees C (50 degrees F) while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

## 1.5 WARRANTY

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

# PART 2 PRODUCTS

## 2.1 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Tile shall be impact resistant with a minimum breaking strength for wall tile of 41 kg (90 lbs) and 113 kg (250 lbs) for floor tile in accordance with ASTM C 648. Tile for cold climate projects shall be rated frost resistant by the manufacturer as determined by ASTM C 1026. Water absorption shall be 0.5 maximum percent in accordance with ASTM C 373. Floor tile shall have a minimum static coefficient of friction of 0.5 in accordance with ASTM C 1028. Tile shall be Class III as rated by the manufacturer when tested in accordance with ASTM C 1027 for abrasion resistance as related to foot traffic.

### 2.1.1 Mosaic Tile

Ceramic mosaic tile and trim shall be unglazed porcelain unpolished with sharply formed face. Tile size shall be 50 by 50 mm (2 by 2 inches). Color shall be in accordance with Section 09915 COLOR SCHEDULE.

2.1.2 Quarry Tile

Quarry tile and trim shall be unglazed with smooth surface. Tile shall be 150 by 150 by 13 mm (6- by 6- by 1/2 inch). Color shall be in accordance with Section 09915 COLOR SCHEDULE.

2.1.3 Glazed Wall Tile

Glazed wall tile and trim shall be cushion edged with matte glaze. Tile shall be 106 by 106 (4-1/4 by 4-1/4 inches). Color shall be in accordance with Section 09915 COLOR SCHEDULE.

2.1.4 Accessories

Accessories shall be the built-in type of the same materials and finish as the wall tile. Accessories shall be provided as follows: Cove base, inside corners, outside corners and caps.

2.2 SETTING-BED

The setting-bed shall be composed of the following:

2.2.1 Aggregate for Concrete Fill

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

2.2.2 Portland Cement

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

2.2.3 Sand

Sand shall conform to ASTM C 144.

2.2.4 Hydrated Lime

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

2.2.5 Metal Lath

Metal lath shall be flat expanded type conforming to ASTM C 847, and weighing not less than 1.4 kg/square meter (2.5 pounds per square yard).

2.2.6 Reinforcing Wire Fabric

Wire fabric shall conform to ASTM A 185. Wire shall be either 50 by 50 mm (2- by 2-inch) mesh, 16/16 wire or 38 by 50 mm (1-1/2 by 2 inch) mesh, 16/13 wire.

2.3 WATER

Water shall be potable.

2.4 MORTAR, GROUT, AND ADHESIVE

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

2.4.1 Dry-Set Portland Cement Mortar

ANSI A118.1.

2.4.2 Conductive Dry-Set Mortar

ANSI A118.2.

2.4.3 Latex-Portland Cement Mortar

ANSI A118.4.

2.4.4 Ceramic Tile Grout

ANSI A118.6; latex-portland cement grout.

2.4.5 Organic Adhesive

ANSI A136.1, Type I.

2.4.6 *Omitted*
2.4.7 *Omitted*

2.4.8 Cementitious Backer Board

Cementitious backer units shall comply with ANSI A118.9.

2.5 MARBLE THRESHOLDS

Marble thresholds shall be of size required by drawings or conditions. Marble shall be Group A as classified by the MIA-01. Marble shall have a fine-sand-rubbed finish and shall be gray in color as approved by the Contracting Officer. Marble abrasion shall be not less than 12.0 when tested in accordance with ASTM C 241.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

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

| TYPE | WALLS | FLOORS |
|---|---|---|
| Dry-Set Mortar | 3 mm in 2.4 meter | 3.0 mm in 3 meter |
| Organic Adhesives | 3 mm in 2.4 meter | 1.5 mm in 1 meter |
| Latex portland cement mortar | 3 mm in 2.4 meter | 3.0 mm in 3 meter |
| Epoxy | 3 mm in 2.4 meter | 3.0 mm in 3 meter |

| TYPE | WALLS | FLOORS |
|---|---|---|
| Dry-Set Mortar | 1/8 inch in 8 ft. | 1/8 inch in 10 ft. |
| Organic Adhesives | 1/8 inch in 8 ft. | 1/16 inch in 3 ft. |
| Latex portland cement mortar | 1/8 inch in 8 ft. | 1/8 inch in 10 ft. |
| Epoxy | 1/8 inch in 8 ft. | 1/8 inch in 10 ft. |

3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective surfaces

in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

## 3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with the TCA-01, method W202.

### 3.3.1 Workable or Cured Mortar Bed

Tile shall be installed over a workable mortar bed or a cured mortar bed at the option of the Contractor. A 0.102 mm (4-mil) polyethylene membrane, metal lath, and scratch coat shall also be installed. Workable mortar bed, materials, and installation of tile shall conform to ANSI A108.1A. Cured mortar bed and materials shall conform to ANSI A108.1B.

### 3.3.2 Latex-Portland Cement Mortar

Latex-portland cement shall be used to install tile in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

## 3.4 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with TCA-01, method F121. Shower receptors shall be installed in accordance with TCA-01, method B415.

### 3.4.1 Workable or Cured Mortar Bed

Floor tile shall be installed over a workable mortar bed or a cured mortar bed at the option of the Contractor. Workable mortar bed materials and installation shall conform to ANSI A108.1A. Cured mortar bed and materials shall conform to ANSI A108.1B. Joints between quarry tile shall be between 6.35 mm (1/4 inch) and 9.53 mm (3/8 inch) in width and shall be uniform in width.

### 3.4.2 Dry-Set and Latex-Portland Cement

Dry-set or latex-portland cement mortar shall be used to install tile directly over properly cured, plane, clean concrete slabs in accordance with ANSI A108.5. Latex portland cement shall be used when installing porcelain ceramic tile.

### 3.4.3 *Omitted*

### 3.4.4 Ceramic Tile Grout

Ceramic tile grout shall be prepared and installed in accordance with ANSI A108.10.

### 3.4.5 Waterproofing

Shower pans are specified in Section 15400 PLUMBING, GENERAL PURPOSE.

### 3.4.6 Concrete Fill

Concrete fill shall be composed by volume of 1 part portland cement to 3 parts fine aggregate to 4 parts coarse aggregate, and mixed with water to as dry a consistency as practicable. The fill shall be spread, tamped, and screeded to a true plane, and pitched to drains or leveled as shown. Concrete fill shall be thoroughly damp-cured before application of setting-bed material thereon.

Concrete fill shall be reinforced with one layer of reinforcement, with the uncut edges lapped the width of one mesh and the cut ends and edges lapped not less than 50 mm (2 inches). Laps shall be tied together with 1.3 mm (18 gauge) wire every 250 mm (10 inches) along the finished edges and every 150 mm (6 inches) along the cut ends and edges. The reinforcement shall be supported and secured in the centers of concrete fills. The mesh shall be continuous; except where expansion joints occur, mesh shall be cut and discontinued across such joints. Reinforced concrete fill shall be provided under the setting-bed where the distance between the under-floor surface and the finished tile floor surface is 50 mm (2 inches) or greater, and shall be of such thickness that the mortar setting-bed to be placed over the concrete fill shall be not less than 19 mm (3/4 inch) nor more than 31 mm (1-1/4 inches) thick at any point.

3.4.7 Cementitious Backer Board

Cementitious backer units shall be installed in accordance with ANSI A108.11.

3.5 *OMITTED*

3.6 INSTALLATION OF MARBLE THRESHOLDS

Thresholds shall be installed where indicated in a manner similar to that of the ceramic tile floor. Thresholds shall be the full width of the opening. Head joints at ends shall not exceed 6 mm (1/4 inch) in width and shall be grouted full as specified for ceramic tile.

3.7 *OMITTED*

3.8 CONTROL JOINTS

Joints shall be formed as indicated and sealed as specified in Section 07920 JOINT SEALING.

3.8.1 Walls

Control joints shall be provided at control joints in backing material. Wherever backing material changes, a control joint shall be formed to separate the different materials.

3.8.2 Floors

Control joints shall be provided over construction joints, control joints, and expansion joints in concrete slabs. Control joints shall also be provided where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 7.2 to 10.8 m (24 to 36 feet) each way in large interior floor areas and 3.6 to 4.8 m (12 to 16 feet) each way in large exterior areas or areas exposed to direct sunlight or moisture. Expansion joints shall extend through setting-beds and fill.

3.9 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection.

Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

-- End of Section --

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 (1988) 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) 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
*4 color shall be as specified. The Contractor has the option to substitute English inch-pound (soft metric) recessed light fixtures (RLF) for hard metric recessed light fixtures. English inch-pound acoustical ceiling tile systems, including acoustical ceiling tiles, recessed light fixtures, air diffusers, air registers and grilles, shall be provided with the English inch-pound recessed light fixtures, provided that they do not interfere with other design requirements. All other criteria contained in this specification applies to both hard metric and English inch-pound acoustical tile systems. For
*5 additional guidance see specification Section ~~01415~~ 01030 METRIC MEASUREMENTS. 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; GA.

Manufacturer's descriptive data and installation instructions.

SD-04 Drawings

Acoustical Ceiling System; GA.

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]~~ *2 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; GA.

Two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed to assure temperature and moisture conditions.

1.5 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 16 degrees C (60 degrees F) nor more than 27 degrees C (80 degrees F) and a relative humidity of not more than 70 percent shall be maintained before, during, and after installation of acoustical units.

1.6 SCHEDULING

Interior finish work such as plastering, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

Acoustical units shall conform to ASTM E 1264, Class A, and the following requirements:

2.1.1 Units for Exposed-Grid System

Type: III A
NRC grade: 60 minimum when tested on mounting No. 7.

Pattern: C, I.
Nominal size: 600 by 600 mm, (24 by 24 inches).
Edge detail: Angle and tegular.
Finish: Factory-applied standard finish.
LR grade: .80.
CAC range: 35-39.

Type: III B high humidity product for 95% relative humidity.
NRC grade: 85 minimum when tested on mounting No. 7.
Pattern: C, E.
Nominal size: 600 by 600 mm. (24 by 24 inches).
Edge detail: Trimmed and butt.
Finish: Factory-applied standard finish.
LR grade: .80.
CAC range: 25-29.

## 2.2 SUSPENSION SYSTEM

Suspension system shall be standard exposed-grid, standard width flange as shown on drawing, and shall conform to ASTM C 635 for intermediate-duty systems. Surfaces exposed to view shall be aluminum or steel with a factory-applied white aluminum with a clear anodized finish. Wall molding shall have a flange of not less than 23 mm (15/16 inch) and shall be provided with outside corner caps. Inside corner caps shall be provided where, due to the configuration of the installation, they are needed to produce a workmanlike appearance.

## 2.3 HANGERS

Hangers shall be galvanized steel wire. Hangers and attachment shall support a minimum 1330 N (300-pound) ultimate vertical load without failure of supporting material or attachment.

## 2.4 ACCESS PANELS

Access panels shall match adjacent acoustical units and shall be designed and equipped with suitable framing and fastenings for removal and replacement without damage. Panel shall be not less than 300 by 300 mm (12 by 12 inches) or more than 300 by 600 mm (12 by 24 inches). An identification plate of 0.8 mm (0.032 inch) thick aluminum, 19 mm (3/4 inch) in diameter, stamped with the letters "AP" and finished the same as the unit, shall be attached near one corner on the face of each access panel.

## 2.5 FIRE RESISTIVE CEILINGS

Acoustical ceiling systems indicated as fire resistant shall be rated for fire endurance as indicated when tested in accordance with ASTM E 119. Suspended ceiling shall have been tested with a specimen roof assembly representative of the indicated construction, including mechanical and electrical work within ceiling space openings for light fixtures, and air outlets, and access panels. Ceiling assembly rating shall be 1 hour exposed grid system.

## 2.6 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.

## 2.7 COLORS AND PATTERNS

Colors and patterns for acoustical units and suspension system components shall be as specified in Section 09915 COLOR SCHEDULE.

## 2.8 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 (3 inches) from ends of each length and not more than 400 mm (16 inches) on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.

### 3.1.3 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if units weigh less than 5 kg per square m (1 psf) or if required for fire resistance rating.

## 3.2 CEILING ACCESS PANELS

Ceiling access panels shall be located directly under the items which require access.

## 3.3 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.

-- End of Section --

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

ASTM F 1344 (1991) Rubber Floor Tile

FEDERAL SPECIFICATIONS (FS)

FS RR-T-650 (Rev D) Treads, Metallic and Nonmetallic, Skid Resistant

FS SS-T-312 (Rev B; Int Am 1; Notice 1) Tile, Floor: Asphalt, Rubber, Vinyl Vinyl-Asbestos

1.2 SUBMITTALS

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

SD-14 Samples

Resilient Flooring and Accessories; FIO.

Three samples of each indicated color and type of flooring and base. Sample size shall be minimum 75 mm by 125 mm (3 inches by 5 inches).

1.3 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 (70 degrees F) for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 21 degrees C (70 degrees F) for 2 days before application, during application and 2 days after application. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter.

1.5 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

1.6 EXTRA MATERIALS

Extra flooring material of each color and pattern shall be furnished at the rate of 10 tiles for each 1000 tiles installed. Extra materials shall be from the same lot as those installed. Extra base material composed of 6 m (20 linear feet) of each color shall be furnished.

PART 2 PRODUCTS

2.1 VINYL-COMPOSITION TILE

Vinyl-composition tile shall conform to ASTM F 1066, Class 1 solid color tile, Composition 1, asbestos-free, and shall be 300 mm square (12 inches square) and 3.2 mm (1/8 inch) 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 indicated.

2.2 *OMITTED*
2.3 *OMITTED*
2.4 *OMITTED*
2.5 *OMITTED*

2.6 RESILIENT BASE

Base shall be straight (installed with carpet) and coved (installed with resilient flooring). Base shall be 100 mm (4 inches) high and a minimum 3 mm (1/8 inch) thick. Preformed outside conrers shall be furnished. Color shall be as indicated.

2.7 EDGE STRIP

Edge strip shall be vinyl, 25 mm (1 inch) wide, and of thickness to match the flooring. Color shall match wall base color unless otherwise indicated.

2.8 ADHESIVE

Adhesive for flooring and wall base shall be as recommended by the flooring manufacturer.

2.9 POLISH

Polish shall conform to ASTM D 4078.

## 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.

### 3.4 INSTALLATION OF VINYL-COMPOSITION TILE AND SOLID VINYL 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 *OMITTED*
### 3.6 *OMITTED*
### 3.7 *OMITTED*

### 3.8 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.

### 3.9 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.

### 3.10 *OMITTED*

### 3.11 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, except for raised pattern flooring and static control vinyl tile, given two coats of polish. After each polish coat, floors shall be buffed to an even luster with an electric polishing machine.

## 3.12 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage. Flooring which becomes damaged, loose, broken, or curled shall be removed and replaced.

-- End of Section --

SECTION 09680

CARPET

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 16 (1993) Test Method: Colorfastness to Light

AATCC 134 (1991) Test Method: Electrostatic Propensity of Carpets

AATCC 165 (1993) Test Method: Colorfastness to Crocking: Carpets - AATCC Crockmeter Method

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 297 (1993) Rubber Products - Chemical Analysis

ASTM D 418 (1993) Pile Yarn Floor Covering Construction

ASTM D 1335 (1967; R 1972) Tuft Bind of Pile Floor Coverings

ASTM D 1667 (1976; R 1990) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)

ASTM D 3676 (1978; R 1989) Rubber Cellular Cushion Used for Carpet or Rug Underlay

ASTM D 3936 (1980) Delamination Strength of Secondary Backing of Pile Floor Coverings

ASTM E 648 (1994a) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CARPET AND RUG INSTITUTE (CRI)

CRI 104 (1994) Commercial Carpet Installation Standard

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1630 Standard for the Surface Flammability of Carpet and Rugs

FEDERAL SPECIFICATIONS (FS)

FS DDD-C-001023 (Basic; Am 1) Cushion, Carpet and Rug (Hair Felt and Rubber Coated Jute and Animal Hair or Fiber)

FS L-C-001369 (Basic) Cushion, Carpet and Rug, Bonded Urethane

FS L-C-001676 (Basic; Am 1) Cushion, Carpet and Rug, Virgin Urethane

FS ZZ-C-00811 (Rev B) Cushion, Carpet and Rug, Cellular Rubber

GERMANY INSTITUTE FOR STANDARDIZATION (DEUTSCHES INSTITUTE FUR NORMUNG) (DIN)

DIN 54318 (1986) Machine-Made Textile Floor Coverings; Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions; Identical with Iso 2551 Edition 1981

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

Carpet and Accessories; FIO.

For each type of carpet material and installation accessory required, catalog data and printed documentation stating physical characteristics, durability, resistance to fading and flame resistance characteristics.

SD-04 Drawings

Installation; FIO.

Layout drawings indicating areas receiving carpet, direction of pile, location of seams and locations of edge molding.

SD-06 Instructions

Carpet and Accessories; FIO.

Three copies of the manufacturer's printed installation instructions for the carpet, including procedures for installation, preparation of substrate, seaming techniques and recommended adhesives and tapes.

SD-09 Reports

Moisture Tests; FIO.

Test reports of moisture content of concrete slab stating date of test, person conducting the test and the area tested.

SD-13 Certificates

Carpet and Accessories; FIO.

Certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet and cushion material conforms to the standards specified.

SD-14 Samples

Carpet and Accessories; FIO.

a. Carpet: Two "Production Quality" samples 675 by 450 mm (27 by 18 inches) of each carpet proposed for use, showing quality, pattern and color specified.

b. Separate Carpet Cushion: Two samples, when tackless installation is specified.

c. Vinyl or Aluminum Moldings: Two pieces of each type at least 300 mm (12 inches long).

d. Special Treatment Materials: Two samples showing system and installation method proposed.

SD-19 Operation and Maintenance Manuals

Carpet and Accessories; FIO.

Three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods and cleaning cycles.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number and related information. Materials shall be stored in a clean, dry, well ventilated area, protected from damage and soiling and maintained at a temperature above 16 degrees C (60 degrees F) for 2 days prior to installation.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C (60 degrees F) for 2 days before installation, during installation, and for 2 days after installation. A minimum temperature of 13 degrees C (55 degrees F) shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

1.5 WARRANTY

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

1.6 EXTRA MATERIAL

Extra material from same dye lot consisting of full width continuous broadloom shall be provided for maintenance. A minimum of 2 percent of total square meters (square yards) of each carpet type, pattern, and color shall be provided.

PART 2 PRODUCTS

2.1 CARPET TYPE A Loop Pile Graphic Pattern Geometrical Design

Carpet shall be first quality; free of visual blemishes, streaks, poorly dyed areas and other physical and manufacturing defects. Carpet materials and treatments shall be reasonably nonallergenic and free of other recognized health hazards.

2.1.1 Physical Characteristics

Carpet shall comply with the following:

a. Carpet Fabrication: Tufted.

b. Category: Broadloom

c. Pile Type: Level-loop

d. Pile Fiber: Branded commercial nylon continuous filament

e. Pile or Wire Height: 4.5 mm (.187 inch).

f. Gauge 10 mm (1/10 inch).

g. Stitches and Tufts: 235,600 per square meter (152 per square inch).

h. Surface Pile Yarn Weight, (or Face Weight): .76 kg per square meter (32 ounces per square yard). This does not include weight of backings. Weight of actual surface yarn exposed to wear above carpet backing shall be determined in accordance with ASTM D 418.

i. Pile Density: 146 (6160) as determined using the formula below.

$$\text{Density} = \frac{(W)(36)/T}{\frac{.76\ (36)}{.187 \text{ inch}}}$$

W is pile yarn weight in kg per square meter (ounces per square yard) and T is pile thickness in inches. Pile thickness shall be determined in accordance with ASTM D 418.

j. Dye Method: Solution dyed - synthetic yarn which is spun from a colored solution with the filament impregnated with the pigment.

k. Backing Materials: Primary backing materials shall be polypropylene. Secondary backing to suit project requirements shall be those customarily used and accepted by the trade for each type of carpet, except when a special unitary back designed for gluedown is provided.

l. Width: 3.6 m (12 feet) minimum usable carpet.

m. Pattern, texture, and color: As indicated.

2.1.2 Performance Requirements

a. Static Control: Static control shall be provided to permanently control static buildup to less than 3,500 volts when tested at 20 percent relative humidity and 21 degrees C (70 degrees F) in accordance with AATCC 134.

b. Flammability and Critical Radiant Flux Requirements: Carpet shall comply with 16 CFR 1630. Carpet in corridors and exits shall have a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E 648. Carpet with separate cushion where used in corridors and exits shall be tested together as an assembly.

c. Tuft Bind: Tuft bind shall be a minimum 40 N (9-pound) average force for loop pile when tested in accordance with ASTM D 1335.

2.2 *OMITTED*

2.3 ADHESIVES AND CONCRETE PRIMER

Adhesives and concrete primers for installation of carpet shall be waterproof, nonflammable, meet local air-quality standards, and shall be as recommended by the carpet manufacturer. Seam adhesive shall be waterproof, nonflammable and

nonstaining as recommended by the carpet manufacturer. Release adhesive for modular tile carpet shall be as recommended by the carpet manufacturer.

## 2.4 MOLDING

Molding shall be vinyl. Vinyl molding shall be heavy-duty and designed for the type of carpet being installed. Floor flange shall be a minimum 50 mm (2 inches) wide. Color shall match rubber wall base.

## 2.5 TAPE

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

# PART 3 EXECUTION

## 3.1 SURFACE PREPARATION

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, or rough areas shall be repaired using material recommended by the carpet or adhesive manufacturer. Floor shall be free of any foreign materials and swept broom clean. Before beginning work, subfloor shall be tested with glue and carpet to determine "open time" and bond.

## 3.2 MOISTURE TEST

Concrete slab shall be tested for moisture content. The moisture content shall not exceed a hygrometer reading of 65 percent.

## 3.3 INSTALLATION

Installation shall be in accordance with the manufacturer's instructions and CRI 104. Edges of carpet meeting hard surface flooring shall be protected with molding. Installation shall be in accordance with the molding manufacturer's instructions.

### 3.3.1 Broadloom of Installation

Broadloom carpet shall be installed direct glue down and shall be smooth, uniform, and secure, with a minimum of seams. Seams shall be uniform, unnoticeable, and treated with a seam adhesive. Side seams shall be run toward the light where practical and where such layout does not increase the number of seams. Breadths shall be installed parallel, with carpet pile in the same direction. Patterns shall be accurately matched. Cutouts, as at door jambs, columns and ducts shall be neatly cut and fitted securely. Seams at doorways shall be located parallel to and centered directly under doors. Seams shall not be made perpendicular to doors or at pivot points. Seams at changes in directions of corridors shall follow the wall line parallel to the carpet direction. Corridors with widths less than 1.8 m (6 feet) shall have the carpet laid lengthwise down the corridors.

### 3.3.2 Modular Tile Installation

Modular tiles shall be installed with a release adhesive and shall be snugly jointed together.

## 3.4 CLEANING AND PROTECTION

### 3.4.1 Cleaning

After installation of the carpet, debris, scraps, and other foreign matter shall be removed. Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Protruding face yarn shall be cut off and removed. Carpet shall be vacuumed clean.

3.4.2 Protection

The installed carpet shall be protected from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood or hardboard sheets. Edges of kraft paper protection shall be lapped and secured to provide a continuous cover. Traffic shall be restricted for at least 45 hours. Protective covering shall be removed when directed by the Contracting Officer.

3.5 REMNANTS

Remnants remaining from the installation, consisting of scrap pieces more than 600 mm (2 feet) in dimension with more than 0.6 square meters (6 square feet) total, shall be provided. Non-retained scraps shall be removed from site.

-- End of Section --

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 (1991) 1991-1992 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 150 (1992) Portland Cement

ASTM D 3273 (1986; R 1991) Resistance to Growth of Mold on the Surface of Interior Coating in an Environmental Chamber

ASTM D 3274 (1982; R 1988) 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

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1500 (Rev A) Sealer, Surface (Latex Block Filler)

CID A-A-1550 (Basic) Wax, General Purpose, Solvent Type

FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1 (Rev H; Change 1 and 2) Obstruction Marking and Lighting

FEDERAL SPECIFICATIONS (FS)

FS P-W-155 (Rev C; Int Am 1) Wax, Floor, Water-Emulsion

FS TT-C-535 (Rev B; Am 2) Coating, Epoxy, Two Component, for Interior Use on Metal, Wood, Wallboard, Painted Surfaces Concrete and Masonry

FS TT-C-542 (Rev E) Coating, Polyurethane, Oil-Free, Moisture Curing

FS TT-C-555 (Rev B; Am 1) Coating, Textured (for Interior and Exterior Masonry Surfaces)

FS TT-E-487 (Rev E; Am 1) Enamel: Floor and Deck

FS TT-E-489 (Rev H) Enamel, Alkyd, Gloss, Low VOC Content

| | |
|---|---|
| FS TT-E-496 | (Rev B; Am 3) Enamel: Heat-Resisting (400 degrees F.), Black |
| FS TT-E-505 | (Rev B) Enamel (Odorless, Alkyd, Interior, High Gloss) |
| FS TT-E-506 | (Rev K; Am 1) Enamel, Alkyd, Gloss, Tints and White (for Interior Use) |
| FS TT-E-508 | (Rev C; Am 1) Enamel, Interior Semigloss, Tints and White |
| FS TT-E-509 | (Rev C) Enamel, Odorless, Alkyd, Interior, Semigloss, White and Tints |
| FS TT-E-545 | (Rev C) Primer (Enamel-Undercoat, Alkyd, Odorless, Interior, Flat, Tints and White) |
| FS TT-F-1098 | (Rev D) Filler, Block, Solvent-Thinned, for Porous Surfaces (Concrete Block, Cinder Block, Stucco, Etc.) |
| FS TT-P-19 | (Rev D; Am 1) Paint, Latex (Acrylic Emulsion, Exterior Wood and Masonry) |
| FS TT-P-24 | (Rev E) Paint, Oil (Exterior Concrete and Masonry) |
| FS TT-P-28 | (Rev G) Paint, Aluminum, Heat Resisting (1,200 Degrees F.) |
| FS TT-P-29 | (Rev K) Paint, Latex |
| FS TT-P-30 | (Rev E; Am 1) Paint, Alkyd, Odorless, Interior, Flat, White and Tints |
| FS TT-P-31 | (Rev D) Paint, Oil: Iron-Oxide, Ready-Mixed, Red and Brown |
| FS TT-P-37 | (Rev D; Am 4 Reinstatement Notice) Paint, Alkyd Resin: Exterior Trim, Deep Colors |
| FS TT-P-38 | (Rev E) Paint, Aluminum (Ready-Mixed) |
| FS TT-P-91 | (Rev D; Am 2) Paint, Rubber-Base, for Interior Use (Concrete and Masonry Floors) |
| FS TT-P-95 | (Rev C; Am 1) Paint, Rubber: for Swimming Pools and Other Concrete and Masonry Surfaces |
| FS TT-P-102 | (Rev F) Paint, Oil, (Alkyd Modified, Exterior, Low VOC) |
| FS TT-P-645 | (Rev B) Primer, Paint, Zinc-Molybdate, Alkyd Type |
| FS TT-P-650 | (Rev D) Primer Coating, Latex Base, Interior, White (for Gypsum Wallboard, or Plaster) |
| FS TT-P-1510 | (Rev A; Am 1) Paint, Latex, Exterior, for Wood Surfaces, White and Tints |
| FS TT-P-1511 | (Rev B) Paint, Latex (Gloss and Semigloss, Tints and White) (for Interior Use) |
| FS TT-P-001984 | (Basic) Primer Coating, Latex Base, Exterior, (Undercoat for Wood), White and Tints |
| FS TT-P-002119 | (Basic) Paint, Latex Base, High Traffic Area, Flat and Eggshell Finish (Low Lustre), (For Interior Use) |

FS TT-S-176 (Rev E; Am 1) Sealer, Surface, Varnish Type, Floor Wood or Cork

FS TT-S-708 (Rev A; Am 2) Stain, Oil; Semi-Transparent, Wood, Exterior

FS TT-S-711 (Rev C) Stain; Oil Type, Wood, Interior

FS TT-S-001992 (Basic) Stain, Latex, Exterior for Wood Surfaces

FS TT-V-51 (Rev F) Varnish: Asphalt

FS TT-V-85 (Rev C; Int Am 2) Varnish, Oil, Low Sheen, Brush or Spray Application

FS TT-V-86 (Rev C; Am 1) Varnish, Oil, Rubbing (for Metal and Wood Furniture)

FS TT-V-109 (Rev C) Varnish, Interior, Alkyd-Resin

FS TT-V-119 (Rev D; Am 2) Varnish, Spar, Phenolic-Resin

FS TT-V-121 (Rev H) Varnish, Spar, Water-Resisting

MAPLE FLOORING MANUFACTURERS ASSOCIATION (MFMA)

MFMA-03 (1991) Floor Finish List and Specifications for Heavy Duty and Gymnasium Finishes for Maple, Beech and Birch Floors: MFMA Floor Finish List Number 11

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 5 (1991) Zinc Dust, Zinc Oxide and Phenolic Varnish Paint

SSPC Paint 18 (1991) Chlorinated Rubber Intermediate Coat Paint

SSPC Paint 21 (1991) White or Colored Silicone Alkyd Paint

SSPC Paint 25 (1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)

SSPC SP 1 (1982) Solvent Cleaning

SSPC SP 2 (1989) Hand Tool Cleaning

SSPC SP 3 (1989) Power Tool Cleaning

SSPC SP 6 (1991) Commercial Blast Cleaning

SSPC SP 7 (1991) 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 when the required quantity of a particular batch is 200 L (50 gallons) or less.

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 (50 gallons):

a. A test report showing that the proposed batch to be used meets all specification requirements, or:

b. A test report showing that a previous batch of the same formulation as the batch to be used met all specification requirements, plus, on the proposed batch to be used, a report of test results for properties of weight per liter, (gallon,) viscosity, fineness of grind, drying time, color, and gloss.

SD-13 Certificates

Lead; FIO. Mildewcide and Insecticide; FIO. Volatile Organic Compound (VOC) Content; FIO.

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead. Certificate stating that paints proposed for use meet the VOC regulations of the local Air Pollution Control Districts having jurisdiction over the geographical area in which the project is located.

SD-14 Samples

Moisture-curing Polyurethane; FIO.

A complete moisture-curing polyurethane system applied to a panel of the same material as that on which the coating will be applied in the work and for each color specified. The sample panels will be used for quality control in applying the system.

Paint; 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 (1 quart) sample of each color and batch, except for quantities of 200 liters (50 gallons) or less, shall be taken by random selection from the sealed containers by the Contractor in the presence of a representative of the Contracting Officer. The contents of the containers to be sampled shall be thoroughly mixed to ensure that the sample is representative. Samples shall be identified by

designated name, specification number, manufacturer name and address, batch number, project contract number, intended use, and quantity involved.

## 1.3 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 20 liters (5 gallons). Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 4 and 35 degrees C (40 and 95 degrees F). Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

## 1.4 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports furnished, samples will be retained by the Government for testing should the materials appear defective during or after application. In addition to any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

## 1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 7 and 35 degrees C (45 and 95 degrees F) when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings. Water-thinned coatings shall be applied only when ambient temperature is between 10 and 32 degrees C (50 and 90 degrees F). Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

## 1.6 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

### 1.6.1 Worker Exposures

Exposure of workers to 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 compounds having ineffective physiological properties, such as 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 (50 gallons) or less, an approved first-line proprietary paint material with similar intended 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, and urethane, paints shall be done by the manufacturer. Stains shall conform in shade to manufacturer's standard color. The color of the undercoats shall vary slightly from the color of the next coat.

2.1.2 Mildewcide and Insecticide

Paint specified for all coats applied to fabrics and vapor barrier jackets over insulation and surfaces in toilets and spaces of unconditioned air 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 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.

## PART 3 EXECUTION

### 3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

### 3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed with clean cloths and cleaning solvents prior to mechanical cleaning. Cleaning solvents shall be of low toxicity with a flashpoint in excess of 38 degrees C (100 degrees F). 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. Glaze, efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting. Surfaces to receive polyurethane, chlorinated rubber 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. 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 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 Plaster Surfaces

Plaster shall age at least 30 days before painting. Plaster shall be clean and free from loose matter and shall have an instrument-measured moisture content not exceeding 8 percent.

### 3.2.7 Wood Surfaces

Wood surfaces shall be cleaned of foreign matter. 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. 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. Sanding of wood floors is specified in Section 09560 WOOD STRIP FLOORING. Floors of oak or similar open-grain wood shall be filled with wood filler recommended by the finish manufacturer and the excess filler removed. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter, unless otherwise authorized.

## 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 0.5 L (1 pint) of suitable thinner per liter (gallon). The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed local limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

### 3.3.1 Cement-Emulsion Filler Coat

Cement and aggregate shall be dry-mixed so that uniform distribution and intermixing are obtained. Mixing liquid and one-half of the total amount of water shall be premixed and added gradually to the white portland cement and aggregate with constant stirring until a thick, smooth material is obtained. Emulsion paint shall then be added to the mixture and stirred until uniformity is obtained. The blend shall have a thick, creamy consistency. The remainder of the water shall be added if necessary to obtain a material with adequate application properties. Blending resin emulsion or emulsion paint with any other component shall be done with caution; too rapid an agitation will cause air entrapment and foaming.

### 3.3.2 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and

sealing shall be as recommended by the manufacturer for each type of substrate.

## 3.4 APPLICATION

Painting practices shall comply with applicable 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 (10,000 cubic feet) or less shall be ventilated at a minimum of two 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 (70 mils) all around. Each varnish coat shall be sanded lightly prior to application of subsequent coats.

### 3.4.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

### 3.4.5 Stains

On smooth exterior wood surfaces such as the planed face of bevel siding, the stain shall be applied at a spreading rate of 9.8 to 12.3 square meters per liter (400 to 500 square feet per gallon). On rough surfaces such as an unplaned or scarred face of bevel siding, the stain shall be spread at the rate of 4.9 to 6.1 square meters per liter (200 to 250 square feet per gallon) or as recommended by the manufacturer. Oil-type stain shall be applied by brushing with the grain for the full length of the board or course of siding.

### 3.4.6 Fillers

Concrete and masonry surface voids shall be filled; however, surface irregularities need not be completely filled. The dried filler shall be uniform and free of pinholes. Filler shall not be applied over caulking compound.

#### 3.4.6.1 Cement-Emulsion Filler

Immediately before filler application, surfaces shall be dampened uniformly and thoroughly, with no free surface water visible, by several applications of potable water with a fog spray, allowing time between the sprayings for water to be absorbed. Cement-emulsion filler shall be scrubbed into the surface vigorously with a stiff-bristled brush having tampico or palmyra bristles not longer than 63 mm (2-1/2 inches). At least 24 hours shall elapse before applying exterior emulsion paint over cement-emulsion filler. When the ambient temperature is over 29 degrees C (85 degrees F), cement-emulsion filler surfaces shall be dampened lightly with a fog spray of potable water immediately prior to application of the subsequent paint coat.

#### 3.4.6.2 Solvent-Thinned Filler

Solvent-thinned filler, FS TT-F-1098, shall be applied to dry surfaces only and may be applied by brush or roller. Filler shall be allowed to set for 3 to 5 minutes or until the filler becomes tacky, and the excess material shall then be removed with a rubber squeegee. Surface voids shall be filled; however, surface irregularities need not be completely filled.

#### 3.4.6.3 Latex Filler

Latex filler, CID A-A-1500, shall be applied according to the manufacturer's instructions. Surface voids shall be filled and the filler allowed to dry the length of time specified by the manufacturer prior to applying successive coats of paint.

### 3.4.7 Textured Coating

Application of textured coating, FS TT-C-555, shall be as specified in the manufacturer's printed directions at a rate of 1.1 to 1.3 square meters per liter (45 to 55 square feet per gallon) in one coat.

### 3.4.8 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

## 3.5 PIPE COLOR CODE MARKING

Pipes in exposed areas and in accessible pipe spaces shall be provided with color band and titles adjacent to all valves, except those provided at plumbing fixtures, at not more than 12 meter (40-foot) spacing on straight pipe runs, adjacent to change in direction, and on both sides where pipes pass through walls or floors. Color code marking shall be of the color listed in TABLE I and the size listed in TABLE II. The arrows shall be installed adjacent to each band to indicate the direction of flow in the pipe. The legends shall be printed in upper-case black letters as listed in TABLE I. Letter sizes shall be as listed in TABLE II. Marking shall be painted or applied using colored, pressure-sensitive adhesive markers of standard manufacture. Paint shall be as specified for insulated and uninsulated piping.

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. |
| High temp. water supply | Yellow | Black | H.T.W.S. |
| High temp. water return | Yellow | Black | H.T.W.R. |
| Boiler feed water | Yellow | Black | B.F. |
| Low temp. water supply (heating) | Yellow | Black | L.T.W.S. |
| Low temp. water return (heating) | Yellow | Black | L.T.W.R. |
| Condenser water supply | Green | White | COND. W.S. |
| Condenser water return | Green | White | COND. W.R. |
| Chilled water supply | Green | White | C.H.W.S. |
| Chilled water return | Green | White | C.H.W.R. |
| Treated water | Yellow | Black | TR. WATER |
| Chemical feed | Yellow | Black | CH. FEED |
| Compressed air | Yellow | Black | COMP. AIR |
| Natural gas | Blue | White | NAT. GAS |
| Freon | Blue | White | FREON |
| Fuel oil | Yellow | Black | FUEL OIL |
| Steam | Yellow | Black | STM. |
| Condensate | Yellow | Black | COND. |

_____

TABLE II. COLOR CODE MARKING SIZES

| 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 |

TABLE II. COLOR CODE MARKING SIZES

| Outside Diameter of Pipe Covering (inches) | Length of Color Band (inches) | Arrow Length x Width (inches) | Size of Legend Letters and Numerals (inches) |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Less than 1-1/2 | 8 | 8 x 2-1/4 | 1/2 |
| 1-1/2 to 2-3/8 | 8 | 8 x 2-1/4 | 3/4 |
| 2-1/2 to 7-7/8 | 12 | 8 x 2-1/4 | 1-1/4 |
| 8 to 10 | 24 | 12 x 4-1/2 | 2-1/2 |
| Over 10 | 32 | 12 x 4-1/2 | 3-1/2 |

## 3.6 MISCELLANEOUS PAINTING

### 3.6.1 Lettering

Lettering shall be provided as scheduled on the drawings, shall be block type, and shall be black enamel water-type decalcomania, finished with a protective coating of spar varnish. Samples shall be approved before application.

### 3.6.2 Obstructions To Aviation

The following obstructions to aviation shall be painted in the pattern and color prescribed by FAA AC 70/7460-1: radio antennae pole.

## 3.7 SURFACES TO BE PAINTED

Surfaces listed in the painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled.

## 3.8 SURFACES NOT TO BE PAINTED

Surfaces in the following areas are not to be painted: concealed attic space above ceilings. In addition surfaces of hardware, fittings, and other factory finished items shall not be painted.

## 3.9 CLEANING

Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

## 3.10 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. Contractor options are indicated by ------or------ between optional systems or coats.

EXTERIOR PAINTING SCHEDULE

| Surface | First Coat | Second Coat | Third Coat |
|---|---|---|---|
| Concrete Masonry units. | Cement-emulsion filler | FS TT-P-19 | None |
| | | FS TT-P-19 | None |

NOTE: Cement-emulsion filler coat shall be acrylic-based and shall consist of the following ingredients in the proportion stated: white portland cement, ASTM C 150, Type I, 7.5 kg (16.5 pounds); aggregate 15 kg (33.5 pounds); mixing liquid, factory-prepared acrylic containing 46 to 47 percent solids, 3 liters (0.75 gallon); potable water 4 liters (1 gallon ) maximum; exterior emulsion paint, FS TT-P-19 4 liters (1 gallon). Aggregate shall consist of Washed silica sand of the following gradation:

| U.S. Sieve Size | Percent Sand (by Weight) Passing Individual Sieve |
|---|---|
| 0.850 mm (20) | 100 |
| 0.600 mm (30) | 95 - 100 |
| 0.300 mm (50) | 30 - 65 |
| 0.150 mm (100) | 0 - 10 |
| 0.075 mm (200) | 0 - 1 |

| | | | |
|---|---|---|---|
| Moisture resistant gypsum board | FS TT-P-19 | FS TT-P-19 | FSTT-P-19 |
| Wood, unless otherwise specified. | Primer as recommended by second coat manufacturer | FS TT-P-102 Type II | FS TT-P-102 Type II |
| Ferrous metal unless otherwise specified, including all metals in manholes and utility vaults. | | FS TT-P-102 Type III | FS TT-P-102 Type III |

EXTERIOR PAINTING SCHEDULE

| Surface | First Coat | Second Coat | Third Coat |
|---|---|---|---|
| Ferrous metal: subject to high temperature, from 204 degrees C to 649 degrees C (400 degrees F to 1200 degrees F), as follows: Boiler Flue | FS TT-P-28 | FS TT-P-28 | None |
| | NOTE: Commercial blast-cleaning, SSPC SP 6 required. No pretreatment. Maximum total system thickness: 0.102 mm (4 Mils). | | |
| Galvanized, including all metals in manholes and utility vaults. | SSPC Paint 5 | FS TT-P-102 Type III | FS TT-P-102 Type III |
| Aluminum aluminum-alloy, and other non-ferrous metal (non-galvanized) | FS TT-P-645 | FS TT-E-489, | FS TT-E-489 |
| | | -----or----- | |
| | | SSPC Paint 21, Type I | SSPC Paint 21 Type I |
| Aviation Obstructions | FS TT-P-001984 | FS TT-P-37 | FS TT-P-19 |

INTERIOR PAINTING SCHEDULE

| Surface | First Coat | Second Coat | Third Coat |
|---|---|---|---|
| Concrete floors | | Hardener (See Section 03300) | Hardener |
| Concrete walls and concrete masonry units requiring a smooth paint finish | CID A-A-1500 | FS TT-P-29 | FS TT-P-29 |
| | | ----------or---------- | |
| | | FS TT-P-30 | FS TT-P-30 |
| Concrete: ceilings in following areas: Arms 191 and Weapons Cleaning | Primer as recommended by FS TT-C-555 manufacturer | FS TT-C-555, Type I | FS TT-P-29 |
| Concrete masonry units in areas, unless otherwise specified | | FS TT-P-650 | FS TT-E-505 |
| | | ------or-------- | |
| | | FS TT-E-506 | |
| Plaster and gypsum board: in latrine areas, unless otherwise specified. | FS TT-P-650 | FS TT-E-505 | None |
| | | ----------or---------- | |
| | | FS TT-E-506 | None |
| Concrete masonry units: in shower areas, unless otherwise specified. | CID A-A-1500 | FS TT-P-95, Type II, Class 3 | FS TT-P-95 Type II, Class 1 |
| Plaster and gypsum board: in shower areas, unless otherwise specified. | FS TT-P-95, Type II, Class 3 | FS TT-P-95, Type II, Class 1 | None |

INTERIOR PAINTING SCHEDULE

| Surface | First Coat | Second Coat | Third Coat |
|---|---|---|---|
| Concrete masonry units, plaster, and gypsum board: walls in heavy traffic areas and areas requiring high degress of sanitation in space as follows: vestibules, corridors, training area, equipment maintenance, weapons cleaning, waiting, medical exam and medical | Concrete masonry units CID A-A-1500<br><br>Seal gypsum board and plaster with<br><br>FS TT-P-29<br>------or------<br><br>FS TT-P-650 | FS TT-C-542, Type I Class B | FS TT-C-542, Type I Class B |
| Metal in shower, latrine, and medical areas, other than equipment, machinery. | Ferrous metal: SSPC Paint 5<br>_____<br>Aluminum: FS TT-P-645<br>Galvanized surface: SSPC Paint 5 | FS TT-E-545 | FS TT-E-505<br>--------or-------<br>FS TT-E-506 |
| Ferrous metal unless otherwise specified. | SSPC Paint 5 | FS TT-P-30 | FS TT-P-30 |
| Ferrous metal in concealed damp spaces or in exposed area having unpainted adjacent surfaces as follows: Water Heater Room and Mechanical Rooms 145 and 147. | FS TT-V-51 | None | None |
| Ferrous metal factory-primed mechanical and electrical equipment. | FS TT-E-489, | FS TT-E-489, | None |

INTERIOR PAINTING SCHEDULE

| Surface | First Coat | Second Coat | Third Coat |
|---|---|---|---|
| Galvanized: unless otherwise specified. | SSPC Paint 5 | Two coats of paint to match adjacent areas | |
| Wood: unless otherwise specified. | FS TT-E-545 | FS TT-P-30 | None |
| | | FS TT-E-508 | None |
| | | or | |
| | | FS TT-E-509 | None |
| | | FS TT-E-505 | None |
| | | or | |
| | | FS TT-E-506 | None |
| Wood: stain and varnish finishes as follows: Doors and cabinets inside and out. | FS TT-S-711, fill and sand | FS TT-V-121 In addition a fourth coat of FS TT-V-121 | FS TT-V-121 |
| Metal: Convector enclosures, elect. conduit runs, metallic tubing, uninsulated ducts and pipes, pipe hangers, louvers, grilles, and air outlets in areas having painted adjacent surfaces. | Ferrous metal: SSPC Paint 5<br>Aluminum: FS TT-P-645 Galvanized surface: SSPC Paint 5 | FS TT-E-545 | FS TT-E-506<br>or<br>FS TT-E-505 |
| Facing of vapor barrier jackets of presized or adhesive finished cloth over insulation on pipes, ducts, and equipment in following areas: Water Heater Room, Unit Storage, Maintenance, Mechanical Rooms, S-2 Storage, NBC Storage and TA 50 Gear. maintenance | Two coats of paint to match adjacent areas. | | None |

INTERIOR PAINTING SCHEDULE

| Surface | First Coat | Second Coat | Third Coat |
|---|---|---|---|
| Oil-based caulking compound. | FS TT-P-38 | | Same as adjacent areas |

-- End of Section --

SECTION 09915

COLOR SCHEDULE

PART 1 GENERAL

1.1 OMITTED

1.2 GENERAL

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

1.3 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-14 Samples

Color Board; GA.

6 sets of color boards, 120 days after the Contractor is given notice to proceed, complying with the following requirements:

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

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

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

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

e. Color boards shall be submitted to the following addresses: U.S. Army Engineer District, Savannah, Att: CESA-PM-MB, 100 West Oglethorpe Avenue, Savannah, GA 31401.

PART 2 PRODUCTS

2.1 REFERENCE TO MANUFACTURER'S COLOR

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

## 2.2 COLOR SCHEDULE

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

### 2.2.1 Exterior Walls

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

*12

a. Brick: Light grey manufactured by Boral Brick, Inc.

b. Accent Brick (soldier course at 800mm AFF and all brick below it): Richtex 739.

c. Mortar: Federal Standard No. 37150.

d. Paint No. 1: Federal Standard No. 20040 (doors and frames)

~~d. Paint No. 2: Duron Paint Co. No. 5362M (to match brick, exposed conduits, wall louvers and downspouts)~~

e. Precast Concrete: Architectural Precast Association 161 (SB-L)

f. Glass and Glazing: Bronze VE 4-55 manufactured by Viracon Product

### 2.2.2 Exterior Trim

Exterior trim shall be provided to match the colors listed below

a. Steel Doors and Door Frames: Federal Standard No. 20040

b. Aluminum Doors and Door Frames: YB1N medium bronze standard matt finish manufactured by YKK AP America, Inc.

c. Windows (mullion, muntin, sash, trim, and sill): YB1N medium bronze standard matt finish manufactured by YKK AP America, Inc.

*12

d. Fascia: Federal Standard No. 22144

*12

e. Gutter, Downspouts, Penthouses, Roof Jacks, Fasteners, Straps, and Flashings: Federal Standard No. 22144

f. Handrails and Pipe Bollards: Federal Standard No. 20040

g. Soffits and Ceilings: Federal Standard No. 27886

h. Signage:

1. Frame: Brick Panel
2. Brick Color: Light Grey manufactured by Boral Brick
3. Letters - Federal Standard No. 20040

I. Overhangs: Federal Standard No. 27886

j. Caulking and Sealants: Match lightest adjacent color

*12

k. Steel Antenna Platform: Match metal roof color~~ - Colonial Red by Berridge Manufacturing~~

*12

l. Louvers, Exposed Conduit, Miscellaneous Metals: Match adjacent surface color

2.2.3 Exterior Roof

*12

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

a. Metal: Federal Standard No. 22144

2.2.4 Interior Floor Finishes: Color Scheme “A”

Flooring materials shall be provided to match the colors listed below

a. Carpet: Dimension Carpet “Carnival 557” 23 Greystone

b. Vinyl Composition Tile:

1. Field Color - Armstrong “Stonetex” 52132 Dusty Khaki
2. Accent Color - Armstrong “Stonetex” 52135 Mineral Dust

c. Quarry Tile - Manufactured by Summitville:

1. Color Scheme A1 - No. 44 Oxford Gray
2. Color Scheme A2 - No. 66 Palomino (part of Bid Additive No. 13)

d. Grout - Custom Building Products:

1. Color Scheme A1 - No. 386 Oyster Gray
2. Color Scheme A2 - No. 383 Italian Straw (part of Bid Additive No. 13)

e. Wood: Federal Standard No. 23695

f. Concrete: Clear Sealer

2.2.5 Interior Base Finishes: Color Scheme “A”

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

a. Resilient Base and Edge Strips: Flexco “Wall Flowers” WF-020 Neutrail

b. Quarry Tile: Match quarry tile floor color

c. Grout: Same as floor tile

d. Painted: Federal Standard No. 25237

2.2.6 Interior Wall Finishes: Color Scheme “A”

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

a. Paint: Federal Standard No. 595B Table I No. 20460

b. Vinyl Wall Covering - Koroseal Wall Covering Espree:

1. Color Scheme A1 - Neutral Grey No. 0824-94
2. Color Scheme A2 - Gold No. 0824-27

c. Ceramic Tile - Manufactured by American Olean:

1. Color Scheme A1 - A27 Sand
2. Color Scheme A2 - A16 Maize (part of Bid Additive 13)

d. Ceramic Tile Grout - Custom Building Products:

1. Color Scheme A1 - No. 386 Oyster Gray
2. Color Scheme A2 - No. 383 Italian Straw (part of Bid Additive 13)

e. Wall Mortar: Grey

f. Columns: Exposed steel - match adjacent walls

2.2.7 Interior Ceiling Finishes: Color Scheme “A”

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

a. Acoustical Tile and Grid - Armstrong:

1. Type I - No. 584 Angled Tegular Cirrus white Grid
2. Type II - Ceramguard RH 100 - 600 x 600 Clear Alumn.

b. Paint: Gypsum Board Federal Standard No. 37722

c. Structural Roof Framing: Federal Standard No. 35526

d. Exposed Metal Deck: Federal Standard No. 35526

2.2.8 Interior Trim: Color Scheme “A”

Interior trim shall be provided to match the colors listed below

a. Doors: Federal Standard No. 20227

b. Door Frames: Federal Standard No. 25237

c. Windows (mullion, muntin and sash): Medium bronze (factory finish)

d. Window Sills: Laminated Plastic A-3 Formica No. 924-58 Slate

e. Fire Extinguisher Cabinets: Red

f. Wood Stain: Federal Standard No. 25237

2.2.9 Interior Window Treatment: Color Scheme “A”

Window treatments shall be provided to match the colors listed below

a. Horizontal Blinds: Levolor 692 Twilight

2.2.10 Interior Miscellaneous: Color Scheme “A”

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

a. Toilet Partitions and Urinal Screen: A-1 Formica 917-58 Tidal Sand Matt

b. Plastic Laminate:

1. Color Scheme A-1 Formica No. 917-58 Tidal Sand Matt Finish.
2. Color Scheme A-2 Formica No. 864-58 Cream of Wheat (part of Bid Additive 13)
3. Color Scheme A-3 Formica No. 924-58 Slate

c. Signage Message and Frame Color (including handicapped signage): Beige

d. Signage Background Color (excluding handicapped signage): Brown

e. Lockers: Federal Standard No. 13522

f. Corner Guards: Match wall color

g. Wall Switch Handles and Standard Receptacle Bodies: Grey

h. Electrical Device Cover Plates and Panels: Grey

i. Casework: Federal Standard No. 20372

j. Wire Partitions: Federal Standard No. 35526

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 09950

WALL COVERINGS

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 423 (1990a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM E 84 (1991a) Surface Burning Characteristics of Building Materials

FEDERAL SPECIFICATIONS (FS)

FS CCC-W-408 (Rev D) Wall Covering, Vinyl-Coated

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

Wall Covering and Accessories; FIO.

Manufacturer's descriptive data.

SD-06 Instructions

Installation; FIO.

Installation instructions for wall covering and accessories.

Maintenance; FIO.

Cleaning and maintenance instructions for wall covering and accessories.

SD-14 Samples

Wall Covering and Accessories; FIO.

Three samples of each indicated type, pattern, and color of wall covering required. Samples of wall covering shall be minimum 125 mm by 175 mm (5 inches by 7 inches) and of sufficient size to show pattern repeat. Three samples of each indicated type edge guard and wainscot cap required.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers. Materials shall be stored in accordance with the manufacturer's instructions in a clean dry area with temperature maintained above 16 degrees C (60 degrees F).

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive wall covering shall be maintained at a temperature above 16 degrees C (60 degrees F) for 3 days before, during, and 3 days after application.

1.5 EXTRA MATERIALS

One lineal foot of full-width wall covering for each 30 linear meters (100 lineal feet) of wall covering installed shall be furnished. The wall covering shall be from the same lot as that installed.

PART 2 PRODUCTS

2.1 WALL COVERINGS

Wall coverings shall be manufacturer's standard material designed specifically for the specified use.

2.1.1 Vinyl Wall Covering Type A

Vinyl wall covering shall be a vinyl coated woven or nonwoven fabric with mildew and germicidal additives and shall conform to FS CCC-W-408, Type II, (0.445 to 0.815 kg (13.1 to 24 ounces)) total weight per square meter (yard) and width of 134 mm (inches). Pattern and color of vinyl wall covering shall be as selected from manufacturer's standard colorways and patterns similar to Koroseal Espere.

2.2 *OMITTED*

2.3 EDGE GUARDS

Edge guards shall be 2 mm ((3/32) inch) thick and shall cover 19 mm (3/4 inch) each side of corner at right angles. Edge guards shall be vinyl from the same lot and color.

2.4 *OMITTED*

2.5 PRIMER AND ADHESIVE

Primer and adhesive shall be mildew resistant and of a type recommended by the wall covering manufacturer. Adhesive to install cap shall be of a type recommended by the manufacturer of the wainscot cap.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Wall covering shall not be applied to surfaces that are rough, that contain stains that will bleed through the wall covering, or that are otherwise unsuitable for proper installation. Cracks and holes shall be filled and rough spots shall be sanded smooth. Surfaces to receive wall covering shall be thoroughly dry. Plaster surfaces shall age at least 30 days prior to installation of vinyl wall coverings. Moisture content of plaster, concrete, and masonry shall be tested with an electric moisture meter and reading shall

be not more than 5 percent. Masonry walls shall have flush joints. Concrete and masonry walls shall be coated with a thin coat of joint compound or cement plaster as a substrate preparation. To promote adequate adhesion of wall lining over masonry walls, the walls shall be primed as recommended by the wall lining manufacturer. Surface of walls shall be primed as required by manufacturer's instructions to permit ultimate removal of wall covering from the wall surface. Primer shall be allowed to completely dry before adhesive application.

## 3.2 INSTALLATION

### 3.2.1 Wall Lining

Wall lining shall be installed over masonry walls that are to receive wall covering. Lining shall be installed in accordance with the manufacturer's installation instructions. Lining shall be installed perpendicular to wall covering to prevent overlapping of seams between lining and wall covering.

### 3.2.2 Vinyl and Fabric Wall Covering

Wall covering shall be installed in accordance with the manufacturer's installation instructions. Glue and adhesive spillage shall be immediately removed from wall covering face and seams with a remover recommended by the manufacturer. After the installation is complete, the fabric wall covering shall be thoroughly vacuumed with a ceiling to floor motion.

### 3.2.3 Edge Guards and Wainscot Cap

Edge guards and wainscot cap shall be installed where shown on the drawings and in accordance with the manufacturer's printed instructions. Edge guards shall run from top of base to ceiling in a continuous length.

## 3.3 CLEAN-UP

Upon completion of the work, wall covering shall be left clean and free of dirt or soiling.

-- End of Section --

SECTION 10160

TOILET PARTITIONS

PART 1 GENERAL

1.1 REFERENCES

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

CODE OF FEDERAL REGULATIONS (CFR)

| | |
|---|---|
| CFR 28 Part 36 | Americans with Disabilities Act Accessibility Guidelines |

FEDERAL SPECIFICATIONS (FS)

| | |
|---|---|
| FS RR-P-1352 | (Rev C) Partitions, Toilet, Complete |

FEDERAL STANDARDS (FED-STD)

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

1.2 SYSTEM DESCRIPTION

Toilet partition system, including toilet enclosures, room entrance screens, and urinal screens, shall be a complete and usable system of panels, hardware, and support components. The partition system shall be provided by a single manufacturer and shall be a standard product as shown in the most recent catalog data. The partition system shall comply with FED-STD 795 and CFR 28 Part 36 for areas as shown.

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

Toilet Partition System; FIO.

Manufacturer's technical data and catalog cuts including installation and cleaning instructions.

SD-04 Drawings

Toilet Partition System; FIO.

Drawings showing plans, elevations, details of construction, hardware, reinforcing, fittings, mountings, and anchorings.

SD-14 Samples

Toilet Partition System; FIO.

Manufacturer's standard color charts and color samples.

1.4 DELIVERY, STORAGE, AND HANDLING

Components shall be delivered to the jobsite in the manufacturer's original packaging with the brand, item identification, and project reference clearly marked. Components shall be stored in a dry location that is adequately ventilated and free from dust, water, or other contaminants and shall have easy access for inspection and handling.

1.5 WARRANTY

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

PART 2 PRODUCTS

2.1 TOILET ENCLOSURES

Toilet enclosures shall conform to FS RR-P-1352, Type I, Style C. Width, length and height of toilet enclosures shall be as shown. Finish surface of panels shall be stainless steel Finish 3. Panels indicated to receive toilet paper holders or grab bars as specified in Section 10800 TOILET ACCESSORIES shall be reinforced for the reception of the items required. Grab bars shall comply with FED-STD 795 and CFR 28 Part 36.

2.2 *OMITTED*

2.3 URINAL SCREENS

Urinal screens shall conform to FS RR-P-1352, Type III, Style D. Finish surface of screens shall be stainless steel Finish 3. Width and height of urinal screens shall be as shown.

2.4 HARDWARE

Hardware for the toilet partition system shall conform to FS RR-P-1352 for the specified type and style of partitions. Hardware finish shall be highly resistant to alkalies, urine, and other common toilet room acids.

2.5 COLORS

Color of finishes for toilet partition system components shall be natural brush finish stainless steel.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet partitions shall be installed straight and plumb in accordance with approved manufacturer's instructions with horizontal lines level and rigidly anchored to the supporting construction. Where indicated, anchorage to walls shall be by through-bolting. Drilling and cutting for installation of anchors shall be at locations that will be concealed in the finished work.

## 3.2 ADJUSTING AND CLEANING

Doors shall have a uniform vertical edge clearance of approximately 5 mm (3/16 inch) and shall rest open at approximately 30 degrees when unlatched. Baked enamel finish shall be touched up with the same color of paint that was used for the finish. Toilet partitions shall be cleaned in accordance with approved manufacturer's instructions and shall be protected from damage until accepted.

-- End of Section --

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 A 167 (1993) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM B 221 (1995a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

ASTM D 256 (1993a) Determining the Pendulum Impact Resistance of Notched Specimens of Plastics

ASTM D 635 (1991) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

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

CODE OF FEDERAL REGULATIONS (CFR)

36 CFR 1191 Americans with Disabilities Act (ADA)Accessibility Guidelines for Buildings and Facilities

FEDERAL STANDARDS (FED-STD)

FED-STD 795 (Basic) Uniform Federal Accessibility Standards

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM-500 Series (1988) Metal Finishes Manual for Architectural and Metal Products

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1992) Fire Doors and Windows

SOCIETY OF AMERICAN AUTOMOTIVE ENGINEERS (SAE)

SAE J1545 (1986) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Color Trim

1.2 SUBMITTALS

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

SD-01 Data

Corner Guards; FIO. Wall Guards (Bumper Guards); FIO. Door Protectors; FIO.

Manufacturer's descriptive data, catalog cuts, installation instructions, and recommended cleaning instructions.

SD-04 Drawings

Corner Guards; FIO. Wall Guards (Bumper Guards); FIO. Door Protectors; 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. Door Protectors; FIO.

Statements attesting that the items comply with specified fire and safety code requirements.

SD-14 Samples

Finish; GA.

Manufacturer's standard samples indicating color and texture of materials requiring color and finish selection.

## 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Materials shall be kept dry, protected from weather and damage, and stored under cover. Materials shall be stored at approximately 21 degrees C (70 degrees F) for at least 48 hours prior to installation.

## 1.4 WARRANTY

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

# PART 2 PRODUCTS

## 2.1 GENERAL

To the maximum extent possible, corner guards, door and door frame protectors, wall guards (bumper guards), wall panels and wall covering shall be the standard products of a single manufacturer and shall be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

### 2.1.1 Resilient Material

Resilient material shall consist of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic and shall conform to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance shall be 960.8 N.m/m (18 ft. lb/sq. inch) (18 ft. lbs/sq. inch) when tested in accordance with ASTM D 256, (Izod impact, ft. lbs per sq inch notched).

2.1.1.2 Fire Rating

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. Resilient material used for protection on fire rated doors and frames shall be listed by the testing laboratory performing the tests. Resilient material installed on fire rated wood/steel door and frame assemblies shall have been tested on similar type assemblies. Test results of material tested on any other combination of door/frame assembly will not be acceptable.

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 be 1200 mm (4 feet) high. Mounting hardware, cushions, and base plates shall be furnished. Assembly shall consist of a snap-on corner guard formed from high impact resistant resilient material, minimum 1.98 mm (0.078 inch) thick, mounted on a continuous aluminum retainer. Extruded aluminum retainer shall conform to ASTM B 221, alloy 6063, temper T5 or T6. Flush mounted type guards shall act as a stop for adjacent wall finish material. Factory fabricated end closure caps shall be furnished for top and bottom of surface mounted corner guards. Flush mounted corner guards installed in fire rated wall shall maintain the rating of the wall. Insulating materials that are an integral part of the corner guard system shall be provided by the manufacturer of the corner guard system. Exposed metal portions of fire rated assemblies shall have a paintable surface.

2.2.2 Stainless Steel Corner Guards

Stainless steel corner guards shall be fabricated of 1.58 mm (0.0625 inch) thick material conforming to ASTM A 167, type 302 or 304. Corner guards shall be 1200 mm (4 feet) high. Corner guard shall be formed to dimensions shown.

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/Bed Locators

Wall guards shall consist of snap-on covers of high impact resistant resilient material, minimum 1.98 mm (0.078 inch) thick, mounted over 75 mm (3 inch) wide aluminum, minimum 1.57 mm (0.062 inch) thick retainer, anchored to wall at maximum 600 mm (24 inches) on center.

2.4 DOOR PROTECTORS

Door protection items shall consist of high impact resistant acrylic vinyl or polyvinyl chloride resilient material, minimum 1.52 mm (0.060 inch) thick for doors.

2.5 *OMITTED*

2.6 TRIM, FASTENERS AND ANCHORS

Vinyl trim, fasteners and anchors shall be provided for each specific installation as shown.

2.7 FINISH

2.7.1 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 (0.4 mil) thick. Concealed aluminum shall be mill finish.

2.7.2 Stainless Steel Finish

Finish for stainless steel shall be in accordance with NAAMM-500 Series, finish number 4.

2.7.3 Resilient Material Finish

Finish for resilient material shall be embossed stipple texture with colors in accordance with SAE J1545.

2.8 ADHESIVES

Adhesive for resilient material shall be in accordance with manufacturers recommendations.

2.9 COLOR

Color shall be in accordance with Section 09915 COLOR SCHEDULE.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Corner Guards and Wall Guards (Bumper Guards)

*3 ~~Material shall be mounted at location indicated on floor pattern and wall protection plan in accordance with manufacturer's recommendations.~~

See Corner Guard and Wall Guard Schedule added by Amendment No. 0003.

3.1.2 Door

*3 Surfaces to receive protection shall be clean, smooth, and free of obstructions. Protectors shall be installed after frames are in place, but prior to hanging of doors, in accordance with manufacturer's specific instructions. Adhesives shall be applied in controlled environment in accordance with manufacturer's recommendations. Protection for fire doors and frames shall be installed in accordance with NFPA 80. ~~See Door Schedule drawings for location of protection.~~ See Door Protection Schedule Added by Amendment No. 0003.

*3 3.2 Schedules

3.2.1 Wall Protection Schedule

| Room No. | Type of Protection | Location of Protection |
|---|---|---|
| 102 Waiting | resilient corner guards | all outside corners |
| 115 Waiting | resilient corner guards | all outside corners |
| 124 Waiting | resilient corner guards | all outside corners |
| 172 Waiting | resilient corner guards | all outside corners |
| 179 Corridor | stainless steel corner guards 100mm x 100 at 90° angles | all outside corners |
| 179 Corridor | wall guards 40mm thick x 200mm high | east and west walls full length two rows, one at 190mm AAF and 1200 mm AAF |
| 184 Equipment Maintenance | stainless steel corner guards | all outside corners and steel building columns and CMU door jambs |

3.2.2 Door Protection Schedule

Provide door protection for the following Doors 183, 196, 184, 186, 194 on push side of door. Door protection shall be 900 x 1200.

-- End of Section --

SECTION 10430

EXTERIOR SIGNAGE

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1980) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1994) Safety Glazing Materials Used in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 (1994a) Carbon Structural Steel

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

ASTM A 525 (1993) General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by theHot-Dip Process

ASTM A 570 (1992; R 1993) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM B 26 (1992a) Aluminum-Alloy Sand Castings

ASTM B 62 (1993) Composition Bronze or Ounce Metal Castings

ASTM B 108 (1992a) Aluminum-Alloy Permanent Mold Castings

ASTM B 209 (1992a) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221 (1993) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

ASTM C 1036 (1991) Flat Glass

ASTM D 3841 (1992) Glass-Fiber-Reinforced Polyester Plastic Panels

ASTM E 84 (1994) Surface Burning Characteristics of Building Materials

AMERICAN WELDING SOCIETY (AWS)

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

CODE OF FEDERAL REGULATIONS (CFR)

36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 505 (1988) Metal Finishes Manual for Architectural and Metal Products; Section: Applied Coatings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1993) National Electrical Code

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3611 (1964; Rev C) Plastic Sheet, Polycarbonate General Purpose

1.2 GENERAL

Exterior signage shall be of the size and type shown on the drawings, shall conform to the requirements specified herein, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation. Materials and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.3 SUBMITTALS

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

SD-01 Data

Exterior Signs; GA.

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

SD-04 Drawings

Exterior Signs; GA.

Drawings showing elevations of each type of sign; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction. A schedule showing the location of each sign type shall be included.

SD-06 Instructions

Exterior Signs; FIO.

Manufacturer's installation instructions and cleaning instructions.

SD-14 Samples

Exterior Signs; GA.

One sample of each type of sign. Each sample shall consist of a complete sign panel with letters and symbols. Samples may be installed in the work, provided each sample is identified and location recorded. Two samples of manufacturer's standard color chips for each material requiring color selection.

1.4 DELIVERY AND STORAGE

Materials shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area.

PART 2 PRODUCTS

2.1 COLOR

Color of products shall be in accordance with Section 09915 COLOR SCHEDULE.

2.2 ALUMINUM ALLOY PRODUCTS

Aluminum alloy products shall conform to ASTM B 209 for sheet or plate, ASTM B 221 for extrusions and ASTM B 26 or ASTM B 108 for castings. Aluminum extrusions shall be provided at least 3 mm (1/8 inch) thick and aluminum plate or sheet at least 1.3 mm (16 gauge, 0.0508 inch) thick.

2.2.1 Anodic Coating

Anodized finish shall conform to AA DAF-45 as follows:

a. Clear (natural) designation AA-M10-C22-A31, Architectural Class II 0.010 mm (0.4 mil) or thicker.

b. Integrated color anodized designation AA-M10-C22-A32, Architectural Class 0.010 to 0.018 mm (0.4 to 0.7 mil).

c. Electrolytically deposited color - anodized designation AA-M10-C22-A34, Architectural Class II 0.010 to 0.018 mm (0.4 to 0.7 mil).

2.3 ORGANIC COATING

Surfaces shall be cleaned, primed, and given a two-component acrylic polyurethane finish in accordance with NAAMM AMP 505 with total dry film thickness not less than 0.030 mm (1.2 mils).

2.4 STEEL PRODUCTS

Structural steel products shall conform to ASTM A 36. Sheet and strip steel products shall conform to ASTM A 570.

2.5 CAST METAL

Components shall be fabricated with sharp corners, flat faces, and accurate profiles. Burrs and rough spots shall be removed and polished. Faces shall be finished to a uniform high luster.

2.5.1 Cast Aluminum

Cast aluminum shall be in accordance with ASTM B 108.

2.6 VINYL SHEETING FOR GRAPHICS

Vinyl sheeting shall be in accordance with the flammability requirements of ASTM E 84 and shall be a minimum 0.08 mm (0.003 inch) film thickness. Film shall include a precoated pressure sensitive adhesive backing, Class 1, or positionable pressure sensitive adhesive backing, Class 3.

2.7 *OMITTED*
2.8 *OMITTED*

## 2.9 ACRYLIC SHEET

Acrylic sheet shall be in accordance with the flammability requirements of ASTM E 84 and shall conform to ANSI Z97.1.

## 2.10 POLYCARBONATE SHEET

Polycarbonate sheet shall conform to SAE AMS 3611.

## 2.11 ANCHORS AND FASTENERS

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall match in color and finish.

## 2.12 SHOP FABRICATION AND MANUFACTURE

### 2.12.1 Workmanship

Work shall be assembled in the shop, insofar as practicable, ready for installation at the site. Work that cannot be shop assembled shall be given a trial fit in the shop to ensure proper field assembly. Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Welding to or on structural steel shall be in accordance with AWS D1.1. Welding shall be continuous along the entire area of contact. Exposed welds shall be ground smooth. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable. Items specified to be galvanized shall be by hot-dip process after fabrication if practicable. Galvanization shall be in accordance with ASTM A 123 and ASTM A 525, as applicable. Joints exposed to the weather shall be formed to exclude water. Drainage and weep holes shall be included as required to prevent condensation buildup.

### 2.12.2 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 asphalt varnish or a coat of zinc-molybdate primer to prevent galvanic or corrosive action.

### 2.12.3 Shop Painting

Surfaces of miscellaneous metal work, except nonferrous metal, corrosion resisting steel, and zinc-coated work, shall be given one coat of zinc-molybdate primer or an approved rust-resisting treatment and metallic primer in accordance with manufacturer's standard practice. Surfaces of items to be embedded in concrete shall not be painted. Upon completion of work, damaged surfaces shall be recoated.

2.13 *OMITTED*
2.14 *OMITTED*
2.15 *OMITTED*
2.16 *OMITTED*

2.17 *OMITTED*

### 2.17.1 Typeface

Typeface shall be helvetica medium.

### 2.17.2 Size

Letter size shall be as indicated.

2.18 DIMENSIONAL BUILDING LETTERS

2.18.1 Fabrication

Letters shall be fabricated from cast aluminum or extruded aluminum. Letters shall be cleaned by chemical etching or cleaned ultrasonically in a special degreasing bath. Letters shall be packaged for protection until installation.

2.18.2 Typeface

Typeface shall be helvetica medium.

2.18.3 Size

Letter size shall be as indicated.

2.18.4 Finish

Anodized or two-component acrylic polyurethane finish shall be provided.

2.18.5 Mounting

Threaded studs, of number and size as recommended by manufacturer, shall be secured in quick-setting mortar for concealed anchorage. Letters which project from the building line shall have stud spacer sleeves. Letters, studs, and sleeves shall be of the same material. Templates for mounting shall be supplied.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed in accordance with approved manufacturer's instructions at locations shown on the drawings. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs mounted on other surfaces shall not be installed until finishes on such surfaces have been completed.

3.1.1 Anchorage

Anchorage shall be in accordance with approved manufacturer's instructions. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood.

3.1.2 Protection and Cleaning

*2 The work shall be protected against damage during construction. Hardware ~~[and electrical equipment]~~ shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned in accordance with manufacturer's instructions.

-- End of Section --

SECTION 10440

INTERIOR SIGNAGE

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1980) Designation System for Aluminum Finishes

AA PK-1 (1989) Registration Record of Aluminum Association Alloy Designations and Chemical Composition Limits for Aluminum Alloys in the Form of Castings and Ingot

AA SAA-46 (1978) Standards for Anodized Architectural Aluminum

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 605.2 (1992; Addenda Feb 1994) Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984) Safety Glazing Materials Used in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 209 (1992a) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221 (1993) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

ASTM C 1036 (1991) Flat Glass

CODE OF FEDERAL REGULATIONS (CFR)

36 CFR 1191 Americans with Disabilities Act (ADA)Accessibility Guidelines for Buildings and Facilities

FEDERAL STANDARDS (FED-STD)

FED-STD 795 (Basic) Uniform Federal Accessibility Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1993) National Electrical Code

1.2 GENERAL

Interior signage shall be of the sizes and types shown on the drawings, shall conform to the requirements specified herein, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as

detailed, and related components for a complete installation. Signs shall be the standard product of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening.

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

Interior Signage; FIO.

Manufacturer's descriptive data, catalogs cuts, installation and cleaning instructions.

SD-04 Drawings

Interior Signage; FIO.

Drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, shape and thickness of materials and details of construction. A schedule showing the location of each sign type shall be included.

SD-14 Samples

Interior Signage; FIO.

One sample of each of the following sign types showing typical quality and workmanship. The samples may be installed in the work, provided each sample is identified and location recorded.

a. Direction sign.

b. Door sign.

Two samples of manufacturer's standard color chips for each material requiring color selection.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area.

1.5 EXTRA STOCK

The Contractor shall provide 4 extra frames and extra stock of the following: 4 blank plaques of each color and size for sign types A. 6 pressure-sensitive letters in each color and size for sign type A. 1 changeable message strips for sign type B.

PART 2 PRODUCTS

2.1 COLOR

Color shall be in accordance with Section 09915 COLOR SCHEDULE.

2.2 *OMITTED*

## 2.3 VINYL SHEETING FOR GRAPHICS

Vinyl sheeting for graphics shall be a minimum 0.08 mm (0.003 inch) film thickness. Film shall include a precoated pressure sensitive adhesive backing.

## 2.4 ACRYLIC SHEET

Acrylic sheet for panels and components shall conform to ANSI Z97.1.

## 2.5 PLAQUE SIGNS

Plaque signs shall be a modular type signage system. Signs shall be fabricated of Type ES laminated thermosetting plastic suitable for engraving or acrylic plastic conforming to ANSI Z97.1.

### 2.5.1 Standard Modular Plaque Signs

Plaque signs shall consist of matte finish acrylic plastic, laminated thermosetting Type ES plastic, thickness and size as shown without frames. Corners of signs shall be 13 mm (1/2 inch) radius.

### 2.5.2 Modular Changeable Message Strip Plaque Signs

Changeable message strip plaque signs shall consist of polycarbonate or cast acrylic back laminated to matte finish laminated thermosetting Type ES plastic face with message slots, as detailed, for insertion of changeable message strips. Thickness and size of signs shall be as shown on the drawings. Individual 1.6 mm (1/16 inch) thick message strips to permit removal, change and reinsertion shall be provided as detailed. Corners of signs shall be 13 mm (1/2 inch) radius.

### 2.5.3 Type of Mounting For Plaque Signs

Extruded aluminum brackets, in finish as shown, shall be furnished for hanging, projecting and double-sided signs. Mounting for framed, hanging and projecting signs shall be by holes and screws. Surface mounted signs shall be provided with 1.6 mm (1/16 inch) thick vinyl foam tape or countersunk mounting holes in plaques and mounting screws. Sign inserts shall be provided with 1.6 mm (1/16 inch) thick foam tape.

## 2.6 GRAPHICS

### 2.6.1 Tactile Graphics

Signage that provides permanent general circulation directions or identification of spaces shall be tactile (perceptible to touch) and shall comply with 36 CFR 1191. The 36 CFR 1191 requirements must provide equal or greater accessibility than the requirements of FED-STD 795. Characters, symbols or pictographs on tactile signs shall meet 36 CFR 1191 Grade 2 braile. Characters and symbols shall contrast with their background.

### 2.6.2 Graphics Application

Signage graphics shall conform to the following:

a. Cast aluminum letters 13 mm (3/4 inch) thick shall be provided and fastened to the message panel with concealed fasteners. Aluminum letter finish shall be as shown. Letters shall project 0.13 mm (3/4 inch) minimum from face of panel.

b. Pressure sensitive precision cut vinyl letters shall be provided. Edges and corners of finished letter forms and graphics shall be true and clean.

c. Message shall be applied to panel using the silkscreen process. Silkscreened images shall be executed with photo screens prepared from original art. No handcut screens will be accepted. Original art shall be defined as artwork that is a first generation reproduction of the specified art. Edges and corners shall be clean.

d. Message shall be acrylic letters 3 mm (1/8 inch) thick and chemically welded to 3.17 mm (0.125 inch) thick acrylic backup sheet.

e. Tactile characters and symbols shall be raised 0.8 mm (1/32 inch) minimum from the sign face. Signs shall be of one piece construction. Add-on characters are not acceptable.

2.6.3 Messages

See drawings and schedule for message content, Typeface: Helvetica medium. Type size 16 mm.

2.7 *OMITTED*

2.8 ANCHORS AND FASTENERS

Exposed anchor and fastener materials shall be compatible with metal to which applied and shall have matching color and finish. Anchorage system shall be of the type recommended by the manufacturer of the indicated substrate. Where recommended by signage manufacturer, foam tape pads may be used for anchorage. Foam tape pads shall be minimum 1.5 mm (1/16 inch) thick closed cell vinyl foam with adhesive backing. Adhesive shall be transparent, long aging, high tech formulation on two sides of the vinyl foam. Adhesive surfaces shall be protected with a 5-mil green flatstock treated with silicone. Foam pads shall be sized for the signage as per signage manufacturers recommendations.

2.9 FABRICATION AND MANUFACTURE

2.9.1 Workmanship

Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

2.9.2 Dissimilar Materials

Where dissimilar metals are in contact, the surfaces will be protected to prevent galvanic or corrosive action.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed in accordance with approved manufacturer's instructions at locations shown on the drawings. Signs shall be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs on doors or other surfaces shall not be installed until finishes on such surfaces have been installed.

### 3.1.1 Anchorage

Anchorage shall be in accordance with approved manufacturer's instructions. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood.

### 3.1.2 Protection and Cleaning

The work shall be protected against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames and other sign surfaces shall be cleaned in accordance with the manufacturer's approved instructions.

-- End of Section --

SECTION 10800

TOILET ACCESSORIES

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 1036 (1991) Flat Glass

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2380 (Basic) Dispenser, Paper Towel

CID A-A-2398 (Rev B) Curtain, Shower and Window (Metric - SI)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 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; FIO. Accessory Items; FIO.

One sample of each accessory proposed for use. Approved samples may be incorporated into the finished work, provided they are identified and their locations noted.

SD-19 Operation and Maintenance Manuals

Electric Hand Dryer; 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.

1.3 DELIVERY, STORAGE, AND HANDLING

Toilet accessories shall be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area protected from construction damage and vandalism.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated in accordance with paragraph SCHEDULE. Porcelain type, tile-wall accessories are specified in Section 09310 CERAMIC TILE. Each accessory item shall be complete with the necessary mounting plates, shall be of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be
*2 suited for use with the supporting construction. Exposed fasteners shall have oval heads ~~[be of tamperproof design]~~ and shall be finished to match the accessory.

2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

| Metal | Finish |
|---|---|
| Stainless steel | No. 4 satin finish |
| Carbon steel, copper alloy, and brass | Chromium plated, bright |

2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

2.2.1 *Omitted*

2.2.2 Grab Bar (GB)

Grab bar shall be 1.3 mm (18 gauge), 32 mm (1-1/4 inches) OD Type 304 stainless steel. Grab bar shall be form and length as indicated. Exposed mounting flange shall have set screw mounting holes concealed on the lip of the flange. Grab bar shall have satin finish. Installed bars shall be capable of withstanding a 2.225 kN (500-pound) vertical load without coming loose from the fastenings and without obvious permanent deformation. Space between wall and grab bar shall be 38 mm (1/2 inch).

2.2.3 *Omitted*

2.2.4 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear. Glazing Quality q1 6 mm (1/4 inch) thick conforming to ASTM C 1036. Glass color shall be clear. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 6 mm (1/4 inch) thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint and shall be baked in uniform thickness to provide a protection for

silver and copper coatings which will permit normal cutting and edge fabrication and provide with 3" shelf and stainless steel frame.

2.2.5 *Omitted*
2.2.6 *Omitted*
2.2.7 *Omitted*
2.2.8 *Omitted*
2.2.9 *Omitted*
2.2.10 *Omitted*

2.2.11 Shower Curtain (SC)

Shower curtain shall conform to CID A-A-2398, Style I, size to suit conditions.

2.2.12 Shower Curtain Rods (SCR)

Shower curtain rods shall be Type 304 stainless steel 32 mm (1-1/4 inch) OD by 1.24 mm (0.049 inch) minimum straight to meet installation conditions.

2.2.13 Soap Dispenser (SD)

Soap dispenser shall be surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 1.2 L (40 fluid ounces) with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

2.2.14 Soap Holder (SH)

Soap holder shall be recessed Type 304 stainless steel. Separate supports shall be stainless steel.

2.2.15 *Omitted*
2.2.16 *Omitted*

2.2.17 Soap and Grab Bar Combination, Recessed (SGR)

Soap and grab bar combination shall be recessed type and shall be Type 304 stainless steel, satin finish.

2.2.18 *Omitted*

2.2.19 Towel Pin (TP)

Towel pin shall have concealed wall fastenings, and a pin integral with or permanently fastened to wall flange. Maximum projection shall be 100 mm (4 inches). Design shall be consistent with design of other accessory items.

2.2.20 Toilet Tissue Dispenser (TTD)

Toilet tissue holder shall be Type II - surface mounted with two rolls of tissue mounted horizontally. Cabinet shall be stainless steel, satin finish.

2.2.21 *Omitted*

2.2.22 Waste Receptacle (WR)

Waste receptacle shall be Type 304 stainless steel, designed for recessed mounting. Reuseable liner, of the type standard with the receptacle manufacturer, shall be provided. Capacity shall be not less than .068 cubic

meters. (2.4 cubic feet.) Receptacles with push doors and doors for access to the waste compartment shall have continuous hinges.

2.2.23 Toilet Seat Cover Dispenser (TSCD)

Toilet seat cover dispensers shall be stainless steel and be surface mounted. Dispenser shall have a minimum capacity of 500 seat covers. Dual access dispensers shall have a minimum capacity of 500 seat covers. Dual access dispensers shall have a minimum capacity of 500 seat covers per side. Combination seat cover dispenser, sanitary napkin disposal and/or toilet tissue dispenser shall meet the requirements of this paragraph, as well paragraph Sanitary Napkin and Tampon Disposer (SND) and paragraph Toilet Tissue Dispenser (TTD) as applicable.

2.2.24 Electric Hand Dryer (EHD)

Electric hand dryer shall be wall mounted and shall be designed to operate on 110/125 volts, 60 cycle, single phase alternating current with a heating element core rating of not more than 2100 watts. Dryer housing shall be of single piece construction and shall be chrome plated steel.

PART 3 EXECUTION

3.1 INSTALLATION

Toilet accessories shall be securely fastened to the supporting construction in accordance with the manufacturer's approved instructions. Accessories shall be protected from damage from the time of installation until acceptance.

3.2 SCHEDULE NO. 1

Accessories required: Under Base Bid

| Room or Space | GB | Glass Mirror | SC | SD | SH | SGR | TP | TTD | WR | TSCD | EHD | FSS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 108 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| 131 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| 141 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| 150 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |

3.3 SCHEDULE NO. 2: (For Bid Additive No. 1)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 126 | 0 | 3 | 6 | 3 | 0 | 6 | 6 | 3 | 1 | 3 | 2 | 0 |

3.4 SCHEDULE NO. 3: (For Bid Additive No. 3)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 126 | 0 | 3 | 6 | 3 | 0 | 6 | 6 | 3 | 0 | 3 | 2 | 0 |

3.5 SCHEDULE NO 4: (For Bid Additive No. 13)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 107 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| 133 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| 139 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| 149 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |

End of Section --

SECTION 12390

CABINETS AND COUNTERTOPS

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.

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.9 (1988) Cabinet Hardware

KITCHEN CABINET MANUFACTURERS ASSOCIATION (KCMA)

KCMA A161.1 (1990; Errata May 1991) Recommended Performance & Construction Standards for Kitchen and Vanity Cabinets

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (1991) High-Pressure Decorative Laminates

1.2 DESIGN

Cabinets shall be wood, factory-fabricated and finished in the manufacturer's standard sizes and finishes of the type, design, and configuration indicated. Cabinets shall be constructed as specified and shall meet the requirements of KCMA A161.1. Wall and base cabinet assemblies shall consist of individual units joined into continuous sections. Fastenings shall be accomplished to permit removal and replacement of individual units without affecting the remainder of the installation. Counters shall be provided with watertight sink rim when indicated. Drawers shall be removable and shall be equipped with position stops to avoid accidental complete withdrawals. Shelves shall be fixed or adjustable 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

Cabinets and Countertops; FIO.

Manufacturer's printed data, catalog cuts, and installation instructions.

SD-04 Drawings

Cabinets and Countertops; FIO.

Drawings showing each type of cabinet and related item, and clearly indicating the complete plan and elevations of the cabinets and accessories and pertinent details of construction, fabrication, and attachments.

SD-09 Reports

Cabinets and Countertops; FIO.

Test reports shall certify that all cabinets comply with the requirements of KCMA A161.1. Tests shall be conducted by independent laboratories approved by KCMA. KCMA certification seals affixed to the cabinets will be accepted in lieu of certified test reports.

SD-14 Samples

Cabinets and Countertops; FIO.

In lieu of individual samples, complete minimum size cabinets may be furnished as samples. Mockup units are not acceptable. Samples shall be of sufficient size to show color pattern and method of assembly.

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 shall be approximately 50 mm by 75 mm (2-inch by 3-inch) size.

d. Stain/color samples shall be approximately 50 mm by 75 mm (2-inch by 3-inch) size.

## 1.4 DELIVERY AND STORAGE

Cabinets shall be delivered to the job site wrapped in a protective covering. Cabinets shall be stored in an adequately ventilated, dry location that is free of dust, water, or other contaminants and in a manner to permit access for inspection and handling. Cabinets 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 CABINETS

Wall and base cabinets shall be of the same construction and same outside appearance. Door design shall be solid flush face. Corner cabinets shall be equipped with notched shelving as indicated. Shelves shall be fixed or fully adjustable as indicated. Adjustable shelves shall be capable of adjusting on approximately 31 mm (1-1/4 inch) increments. Shelves shall be supported by self-locking clips or wood dowels. Dowels shall be approximately 8 mm (5/16 inch) in diameter by 39 mm (1-9/16 inches) long. Dowels shall be inserted into borings for the shelf adjustments. Shelves shall be minimum 13 mm (1/2 inch) thick plywood or minimum 13 mm (1/2 inch) thick 20 kg (45-pound) density particle board. Drawer fronts shall be 16 mm (5/8 inch) thick, 5-ply hardwood plywood with 19 mm (3/4 inch) thick solid hardwood frame with hardwood plywood panel.

### 2.1.1 Frame Type Cabinets

The cabinets shall be constructed with frame fronts and solid ends, or frame construction throughout. Frame members shall be 19 mm (3\4 inch) thick by 38 mm (1-1\2 inch) wide; kiln-dried hardwood, glued together, and shall be either mortised and tenoned, dovetailed or doweled, nailed, stapled or screwed. Top and bottom corners shall be braced with either hardwood blocks that are glued together with water-resistant glue and nailed in place, or metal or plastic

corner braces. Backs of wall cabinets shall be 3 mm (1\8 inch) thick plywood or tempered hardboard. Backs of base and tall cabinets shall be 9 mm (3\8 inch) thick hardwood plywood or 9 mm (3\8 inch) thick, 20 kg (45-pound) density particle board. Bottoms of cabinets shall be minimum 9 mm (3\8 inch) thick plywood good grade and shall be braced with wood members glued in place. Cabinet ends shall be 16 mm (5\8 inch) thick hardwood plywood.

## 2.2 COUNTERTOPS AND BACKSPLASH

### 2.2.1 General

Countertop and backsplash shall be constructed of 19 mm (3/4 inch) thick plywood and shall be fully formed type. Fully formed type or square edge shall be a unit with shaped edges using wood nose molding at counter edge and shall include a separate backsplash. Backsplash shall be not less than 88 mm (3-1/2 inches) high. Edging and trim shall consist of plastic laminate cut and fitted to all exposed edges. End splashes constructed of 19 mm (3/4 inch) plywood or 19 mm (3/4 inch) thick, 20 kg (45-pound) density particle board core shall be supplied.

### 2.2.2 Sink Rims

Sink rims shall be of the corrosion-resistant steel clamping type, sized to the sink, and a standard product of a manufacturer regularly producing this type of equipment.

## 2.3 FINISH

### 2.3.1 Cabinet Finish

Cabinets shall be provided with a factory-applied durable finish of a type standard with the manufacturer. Natural finish wood doors, drawer fronts, cabinet fronts, and exposed cabinet sides shall be fabricated of wood which will be free of extreme color variations within each panel or between adjacent panels. Exposed exterior surfaces shall be hardwood or grade A-A hardwood veneer with natural stain and sprayed on polyurethane factory applied finish. Colors shall be selected from manufacturer's standard.

2.3.2 *Omitted*

2.3.3 *Omitted*

### 2.3.4 Backer Sheets

Backer sheets of high pressure plastic laminate, shall conform to NEMA LD 3, Grade BK20 and shall be applied to the underside of all core material. Design, color, and finish shall be selected from manufacturer's standard.

## 2.4 HARDWARE

Hardware shall conform to BHMA A156.9, shall be suitable for kitchen cabinet use, and shall include all miscellaneous hardware for a complete installation. Door hinges shall be self-closing type. Drawer runners shall have nylon rollers standard with the manufacturer. Hardware and fastenings for doors and drawers with particle board cores shall be of the through-bolt type. The types and finishes of hardware shall be as follows:

| | BHMA DESIGNATION | |
|---|---|---|
| Type | Number | Finish |
| Pulls | B52011 | 300 Series Stainless Steel |
| Hinges | B51501 | 300 Series Stainless Steel |
| Catches | B53171 | 300 Series Stainless Steel |
| Shelf Rest | B04011 | Zinc |
| Drawer Slides | B05051 | Zinc |
| Shelf Standards | B04101 | Zinc |
| Brackets | B04111 | Zinc |

PART 3 EXECUTION

3.1 INSTALLATION

Cabinets shall be installed level, plumb, and true to line, and shall be attached to the walls or floors with suitable devices to securely anchor each unit. Countertops, accessories, and hardware shall be installed as indicated. Installation shall be in accordance with the manufacturer's approved printed instructions. The inner edge of sink cut-outs in laminated plastic tops shall be painted with a coat of semigloss enamel paint and sink flanges shall be set in a bed of sealant. Closer and filler strips and finish moldings shall be provided as required. Prior to final acceptance, doors shall be aligned, hardware adjusted, and cabinets left in a clean neat condition.

--End of Section--

SECTION 12540

WINDOW BLINDS, SHADES, AND DRAPERY 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.

FEDERAL SPECIFICATION (FS)

| | |
|---|---|
| FS AA-V-00200 | (Rev B) Venetian Blinds |

NATIONAL FIRE PROTECTION (NFPA)

| | |
|---|---|
| NFPA 701 | (1989) Methods of Fire Test for Flame-Resistant Textiles and Films |

1.2 GENERAL

Horizontal blinds and window shades hardware shall be provided as indicated, complete with necessary brackets, fittings, and hardware. Each window covering type utilized shall be a complete unit produced by one manufacturer. Window coverings shall be provided in accordance with paragraph WINDOW COVERING PLACEMENT SCHEDULE. Equipment shall be mounted as indicated and shall be manually operated. Windows to receive a covering 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. Color shall be as specified in Section09915.

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 Coverings and Hardware; FIO.

Manufacturer's data composed of catalog cuts, brochures, and product information.

SD-04 Drawings

Window Coverings and Hardware; FIO.

Drawings showing fabrication and installation details. The manufacturer's descriptive data will be acceptable, provided this literature accurately shows the items proposed to be furnished and the method of installation. Drawings shall show layout of blinds or shades, and mounting details.

SD-14 Samples

Window Coverings and Hardware; FIO.

Three samples of each type and color of window covering specified. Blind slat shall be 6 inches in length for each color.

SD-19 Operations and Maintenance Manuals

Window Coverings and Hardware; FIO.

Maintenance instructions for window coverings.

1.4 DELIVERY AND STORAGE

The Contractor shall be responsible for the receipt, storage, and handling of materials and supplies necessary to provide a complete installation. Window coverings shall be delivered to the project site in the manufacturer's original unopened containers. Materials shall be stored flat in a clean dry area with temperature maintained above 50 degrees F.

PART 2 PRODUCTS

2.1 WINDOW BLINDS

Each blind, including hardware, accessory items, mounting brackets and fastenings, shall be provided as a complete unit produced by one manufacturer. All parts shall be one color and match the color of the blind slat. Steel features shall be treated for corrosion resistance.

2.1.1 Horizontal Blinds

Horizontal blinds shall conform to FS AA-V-00200, Type I (2-inch slats), except as modified below. Blind units shall be capable of nominally 180-degree partial tilting operation and full-height raising. Blinds shall be inside mount. Tapes for Type I slats shall be longitudinal reinforced vinyl plastic in one piece turn ladder construction.

2.1.1.1 Head Channel and Slats

Head channel shall be steel not less than 0.018 for Type I. Slats shall be aluminum, not less than 0.0080 inch thick, and of sufficient strength to prevent sag or bow in the finished blind. A sufficient amount of slats shall be provided to assure proper control, uniform spacing, and adequate overlap.

2.1.1.2 Controls

The slats shall be tilted by a transparent tilting wand, hung vertically by its own weight, and shall swivel for easy operation. The tilter control shall be of enclosed construction. All moving parts and mechanical drive shall be made of compatible materials which do not require lubrication during normal expected life. The tilter shall tilt the slats to any desired angle and hold them at that angle so that any vibration or movement of ladders and slats will not drive the tilter and change the angle of slats. A mechanism shall be included to prevent over tightening. The wand shall be of sufficient length to reach to within 5 feet of the floor.

2.1.1.3 Intermediate Brackets

Intermediate brackets shall be provided for installation of blinds over 48 inches wide or over 100 inches long and shall be installed as recommended by the manufacturer.

2.2 WINDOW SHADES

Rollers shall be of aluminum and operate by a clutch and bead operation mechanism. Brackets shall be provided that are appropriate for outside mount. The shade cloth shall be vinyl coated fiberglass and be in accordance with NFPA 701. System shall be room darkening to block 100 percent of incoming light and consist of side tracks, bottom channel, and top cover made of anodized aluminum or painted steel. The color shall be selected from the manufacturer's standard colors and as specified in Section 09915. Steel features shall be treated for corrosion resistance.

PART 3 EXECUTION

3.1 WINDOW COVERING PLACEMENT SCHEDULE

Window covering shall be provided as follows:

| Window No./Name | Window Covering Type | Drapery Draw Type/Direction | Window Type |
|---|---|---|---|
| 125 Conference | Horizontal blinds, shades | N/A | A |
| 121 1st Sgt. | Horizontal blinds | N/A | A |
| 119 Commander | Horizontal blinds | N/A | A |
| 117 Commander | Horizontal blinds | N/A | A |
| 116 1st Sgt. | Horizontal blinds | N/A | A |
| 112 Conference | Horizontal blinds, shades | N/A | A |

| Window No./Name | Window Covering Type | Drapery Draw Type/Direction | Type |
|---|---|---|---|
| 104 Commander | Horizontal blinds, shades | N/A | A |
| 103 1st Sgt. | Horizontal blinds | N/A | A |
| 178 Conference | Horizontal blinds, shades | N/A | A |
| 174 Commander | Horizontal blinds, shades | N/A | A |
| 173 1st Sgt. | Horizontal blinds | N/A | A |
| 169 Conference | Horizontal blinds | N/A | A |

3.2 INSTALLATION

Installation shall be in accordance with the approved detail drawings and manufacturer's installation instructions. Units shall be level, plumb, secure, and at proper height and location relative to window units. The Contractor shall furnish and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Installation shall not be initiated until completion of room painting and finishing operations. Upon completion of the installation, window coverings shall be adjusted for form and appearance, in proper operating condition, and free from damage or blemishes. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

--End of Section--

SECTION 13080

SEISMIC PROTECTION FOR MECHANICAL, ELECTRICAL EQUIPMENT

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 Z21.70 | (1981) Earthquake Actuated Automatic Gas Shutoff Systems |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---|---|
| ASTM A 36 | (1994a) Carbon Structural Steel |
| 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 446 | (1993) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Storm Sewer and Drainage Pipe |
| ASTM A 500 | (1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| ASTM A 501 | (1993) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing |
| ASTM A 576 | (1990b) Steel Bars, Carbon, Hot-Wrought, Special Quality |
| ASTM A 603 | (1988) Zinc-Coated Steel Structural Wire Rope |
| ASTM E 488 | (1990) Strength of Anchors in Concrete and Masonry Elements |
| ASTM E 580 | (1991) Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|---|---|
| ASME B18.2.1 | (1981; Supple 1991; R 1992) Square and Hex Bolts and Screws (Inch Series) |
| ASME B18.2.2 | (1987; R 1993) Square and Hex Nuts (Inch Series) |

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

| | |
|---|---|
| ICBO-01 | (1994) Uniform Building Code |

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

| | |
|---|---|
| SMACNA-12 | (1991; Appx E, 1993) Seismic Restraint Manual Guidelines for Mechanical Systems |

UNDERWRITERS LABORATORIES (UL)

| | |
|---|---|
| UL 1570 | (1988; Rev thru Mar 1995) Fluorescent Lighting Fixtures |
| UL 1571 | (1991; Rev thru Mar 1995) Incandescent Lighting Fixtures |

## 1.2 SYSTEM DESCRIPTION

### 1.2.1 General

The requirements for seismic protection measures described in this sectionshall be applied to mechanical/electrical equipment and systems specifiedherein. Seismic protection requirements shall be in accordance with ICBO-01 using an importance factor of 1 and shall be provided inaddition to any other requirements called for in other sections of thesespecifications. This facility shall be designed as being in seismic zone 2A no other zone values shall be used to establish bracingrequirements. Lateral support against earthquake induced forces shall beaccomplished by positive attachments without consideration of frictionresulting from gravity loads.

### 1.2.2 Mechanical/Electrical Equipment

Mechanical/electrical equipment shall include the following items to the extent required on the drawings or in other sections of these specifications:

- Boilers and furnaces
- Water and Gas Piping
- Water Chiller Units
- Air Handling Units
- Pumps with Motors
- Light Fixtures
- Motor Control Centers
- Switchboards (Floor Mounted)
- Suspended Ceiling Assemblies
- Water Heaters
- Expansion Air Separator Tanks
- Control Panels
- Air and Refrigerant Compressors
- Switchgear
- Unit Substations
- Transformers
- Storage Racks
- Ducts
- Unit Heaters
- Exhaust and Return Fans

### 1.2.3 Mechanical/Electrical Systems

The following mechanical and electrical systems shall be installed as required on the drawings and other sections of these specifications and shall be seismically protected in accordance with this specification:

All Piping Inside the Building in Accordance With This Specification
Chilled Water Distribution Systems Outside of Buildings
Gas Distribution Systems
All Water Supply Systems
Storm and Sanitary Sewer Systems

1.2.4 Omitted

1.2.5 Exclusion

Seismic protection of piping for fire protection systems shall be installed as specified in Sections 15330 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION.

1.2.6 Pipes and Ducts Requiring No Special Seismic Restraints

Seismic restraints may be omitted from the following installations:

a. Gas piping less than 25 mm inside diameter.

b. Piping in boiler and mechanical equipment rooms less than 32 mm inside diameter.

c. All other piping less than 38 mm inside diameter.

d. Electrical conduit less than 64 mm inside diameter.

e. Rectangular air handling ducts less than 0.37 square meters in cross sectional area.

f. Round air handling ducts less than 457 mm in diameter.

g. Piping suspended by individual hangers 300 mm or less in length from the top of pipe to the bottom of the supportingstructural member where the hanger is attached, except as noted below.

h. Ducts suspended by hangers 300 mm or less inlength from the top of the duct to the bottom of the supporting structuralmember, except as noted below.

In exemptions g. and h. all hangers shall meet the length requirements. If the length requirement is exceeded by one hanger in the run, the entire runshall be braced.

1.2.7 All Other Interior Piping, Conduit, and Ducts

Interior piping, conduit, and ducts not covered by paragraphs Exclusion or Pipes and Ducts Requiring No special Seismic Restraints shall be seismically protected in accordance with the provisions herein.

1.3 SUBMITTALS

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

SD-01 Data

Bracing and Coupling; FIO. Lighting Fixtures in Buildings; FIO. Miscellaneous

Equipment; FIO.

Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the loadfrom the brace.

SD-04 Drawings

Bracing and Coupling; FIO. Flexible Couplings or Joints; FIO. Resilient Vibration Isolation Devices; FIO. Lighting Fixtures inBuildings; FIO. Miscellaneous Equipment; FIO.

Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details,reinforcement, anchorage, and installation with relation to the building construction.

## 2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the requirements specified below:

### 2.1.1 Bolts and Nuts

Squarehead and hexhead bolts, and heavy hexagon nuts, ASME B18.2.1, ASME B18.2.2, and ASTM A 307 or ASTM A 576. Bolts and nuts used underground and/or exposed to weather shall be galvanized in accordance with ASTM A 325.

### 2.1.2 Sway Bracing

Material used for members listed in this section and on the drawings, shall be structural steel conforming with the following:

a. Plates, rods, and rolled shapes, ASTM A 36.

b. Wire rope, ASTM A 603.

c. Tubes, ASTM A 501.

d. Pipes, ASTM A 500.

e. Light gauge angles, less than 6 mm thickness,ASTM A 446.

### 2.1.3 Flexible Couplings

Flexible couplings shall have same pressure and temperature ratings as adjoining pipe.

#### 2.1.3.1 Flexible Ball Joints

Flexible ball joints shall have cast or wrought steel casing and ball parts capable of 360-degree rotation plus not less than 15-degree angular movement.

#### 2.1.3.2 Flexible Mechanical Joints

a. Mechanical couplings for steel or cast iron pipe shall be of the sleeve type and shall provide a tight flexible joint under all reasonable conditions, such as pipe movement caused by expansion, contraction, slight settling or shifting of the ground, minor variations in trench gradients, and traffic vibrations. Where permitted in other sections of these specifications, joints utilizing split-half couplings with grooved or shouldered pipe ends may be used.

b. Sleeve-type couplings shall be used for joining plain-end pipe sections. The coupling shall consist of one steel middle ring, two steel followers, two gaskets, and necessary steel bolts and nuts to compress the gaskets. Underground bolts shall be high-strength type as specified above.

2.1.4 Lighting Fixture Supports

Fixture supports shall be malleable iron. Lighting fixtures and supports shall conform to UL 1570 or UL 1571 as applicable.

3.1 BRACING AND COUPLING

Bracing and coupling shall conform to the arrangements shown. Provisions of this paragraph apply to all piping within a 1.5 m line around outside of building unless buried in the ground. Piping grouped for support on trapeze-type hangers shall be braced at the same intervals as determined by the smallest diameter pipe of the group. No trapeze-type hanger shall be secured with less than two 13 mm bolts. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would interfere with thermal expansion of piping.

3.2 BUILDING DRIFT

Sway braces for a run shall not be attached to two dissimilar structural elements of a building that may respond differentially during an earthquake unless a flexible joint is provided. Joints capable of accommodating seismic displacements shall be provided where pipes pass through a building seismic or expansion joint, or where rigidly supported pipes connect to equipment with vibration isolators. For threaded piping, swing joints shall be provided. For piping with manufactured ball joints the seismic drift shall be 0.015 meters per meter of height above the base where the seismic separation occurs; this drift value shall be used in place of the expansion given in the manufacturer's selection table.

3.3 FLEXIBLE COUPLINGS OR JOINTS

3.3.1 Building Piping

Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers larger than 90 mm in diameter. Flexible couplings or joints shall be braced laterally withoutinterfering with the action of the flexible coupling or joint. Cast iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets or no-hub fittings may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to comply with these requirements.

3.3.2 Underground Piping

Underground piping and 100 mm or larger conduit, except heat distribution

system, shall have flexible couplings installed where the piping enters the building. The couplings shall accommodate 76 mm of relative movement between the pipe and the building in any direction. Additional flexible couplings shall be provided where shown on the drawings.

3.4 PIPE SLEEVES

Pipe sleeves in interior non-fire rated walls shall be sized as indicated on the drawings to provide clearances that will permit differential movement of piping without the piping striking the pipe sleeve.

3.5 SPREADERS

Spreaders shall be provided between adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 100 mm apart. Spreaders shall be applied at same interval as sway braces at an equal distance between the sway braces. If rack type hangers are used where the pipes are restrained from contact by mounting to the rack, spreaders are not required for pipes mounted in the rack. Spreaders shall be applied to surface of bare pipe and over insulation on insulated pipes utilizing high-density inserts and pipe protection shields in accordance with the requirements of Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.6 ANCHOR BOLTS

3.6.1 Cast-In-Place

Floor or pad mounted equipment shall use cast-in-place anchor bolts, except as specified below. One nut shall be provided on each bolt.
Anchor bolts shall conform to the following tabulation for the various equipment weights and specified seismic zone or the manufacturer's installation recommendations, whichever is the most stringent, unless otherwise shown on the drawings. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

3.6.2 Minimum Bolt Sizes, Cast-In-Place Anchor Bolts

| Max. Equip. Weight Kg | Minimum Bolt Sizes (mm)* Zone 2A |
|---|---|
| 225 | 13 |
| 450 | 13 |
| 2250 | 13 |
| 4500 | 13 |
| 9000 | 13 |
| 13500 | 13 |
| 22500 | 13 |
| 45000 | 16 |

*Based on four bolts per item, a minimum embedment of 12 bolt diameters, a minimum bolt spacing of 16 bolt diameters and a minimum edge distance of 12 bolt diameters. Equivalent total cross-sectional area shall be used when more than four bolts per item are provided. Anchor bolts shall conform to ASTM A 307. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt.

**Equipment weighing more than 22,500 kg in Zones 3 and 4 shall have at least six bolts per item.

3.6.3 Expansion or Chemically Bonded Anchors

Expansion or chemically bonded anchors shall not be used unless test data in accordance with ASTM E 488 has been provided to verify the adequacy of the specific anchor and application. The expansion anchor size shall be not less than that required in paragraph Minimum Bolt Sizes, Cast-In-Place Anchor Bolts. Expansion and chemically bonded anchors shall be installed in accordance with the manufacturer's recommendations. The allowable forces shall be adjusted for the spacing between anchor bolts and the distance between the anchor bolt and the nearest edge, as specified by the manufacturer.

3.6.3.1 General Testing

Expansion and chemically bonded anchors shall be tested in place after installation. The tests shall occur not more than 24 hours after installation of the anchor and shall be conducted by an independent testing agency; testing shall be performed on random anchor bolts as described below.

3.6.3.2 Omitted

3.6.3.3 Pullout Testing

Expansion and chemically bonded anchors shall be tested by applying a pullout load using a hydraulic ram attached to the anchor bolt. At least 5 percent of the anchors, but not less than three per day shall be tested. The load shall be applied to the anchor without removing the nut; when that is not possible, the nut shall be removed and a threaded coupler shall be installed of the same tightness as the original nut. The test setup shall be checked to verify that the anchor is not restrained from withdrawing by the baseplate, the test fixture, or any other fixtures. The support for the testing apparatus shall be at least 1.5 times the embedment length away from the bolt being tested. Each tested anchor shall be loaded to 1 times the design tension value for the anchor. The anchor shall have no observable movement at the test load. If any anchor fails the test, similar anchors not previously tested shall be tested until 20 consecutive anchors pass. Failed anchors shall be retightened and retested to the specified load; if the anchor still fails the test it shall be replaced.

3.7 RESILIENT VIBRATION ISOLATION DEVICES

Selection of anchor bolts for vibration isolation devices and/or snubbers for equipment base and foundations shall follow the same procedure as in paragraph ANCHOR BOLTS except that an equipment weight equal to five times the actual equipment weight shall be used.

3.7.1 Resilient and Spring-Type Vibration Devices

Vibration isolation devices shall be selected so that the maximum movement of equipment from the static deflection point shall be 15 mm.

3.7.2 Multidirectional Seismic Snubbers

Multidirectional seismic snubbers employing elastomeric pads shall be installed on all floor- or slab-mounted equipment. These snubbers shall provide 6 mm free vertical and horizontal movement from the static deflection point. Snubber medium shall consist of multiple pads of cotton duct and neoprene or other suitable materials arranged around a flanged steel trunnion so both horizontal and vertical forces are resisted by the snubber medium.

## 3.8 SWAY BRACES FOR PIPING

Sway braces shall be provided to prevent movement of the pipes under seismic loading. Braces shall be provided in both the longitudinal and transverse directions, relative to the axis of the pipe. The bracing shall not interfere with thermal expansion requirements for the pipes as described in other sections of these specifications.

### 3.8.1 Transverse Sway Bracing

Transverse sway bracing for steel and copper pipe shall be provided at intervals not to exceed those given in the tabulation below as modified for each seismic zone. All runs shall have a minimum of two transverse braces. Transverse sway bracing for pipes of materials other than steel and copper shall be provided at intervals not to exceed the hanger spacing as specified in Section 15400 PLUMBING, GENERAL PURPOSE.

### 3.8.2 Maximum Span for Transverse Sway Braces in Seismic Zone 4

| Pipe Diameter | Std. Wgt. Steel Pipe - 40S | | Copper Tube Type L | |
|---|---|---|---|---|
| (mm) | *L(m) | ** F(kN) | *L(m) | **F(kN) |
| 25 | 6.7 | 0.30 | 3.4 | 0.08 |
| 40 | 7.6 | 0.60 | 3.7 | 0.16 |
| 50 | 8.8 | 1.0 | 4.3 | 0.30 |
| 65 | 9.8 | 1.7 | 4.8 | 0.50 |
| 80 | 10.4 | 2.5 | 5.2 | 0.70 |
| 90 | 11.0 | 3.3 | 5.5 | 1.0 |
| 100 | 11.9 | 4.3 | 5.8 | 1.3 |
| 125 | 12.5 | 6.4 | 6.1 | 2.1 |
| 150 | 13.7 | 9.4 | 6.7 | 3.3 |
| 200 | 14.9 | 16.6 | 7.9 | 6.9 |
| 250 | 16.5 | 27.1 | 8.5 | 11.7 |
| 300 | 17.7 | 38.1 | 9.4 | 17.6 |

*L = Maximum span between lateral supports multiplied by 1.1 for Zone 3, 1.25 for Zone 2A, 1.2 for Zone 2B, or 1.35 for Zone 1.

**F = Horizontal force on the brace multiplied by 0.8 for Zone 3, 0.5 for Zone 2A, 0.6 for Zone 2B, or 0.3 for Zone 1.

NOTE: Bracing shall consist of at least one vertical angle 50 x 50 mm x 16 gauge (2 x 2 x 16 gauge) and one diagonal angle of the same size.

3.8.3 Longitudinal Sway Bracing

Longitudinal sway bracing shall be provided at 12 m intervals except when the location of sway braces is shown on the drawings for the particular piping system. All runs shall have one longitudinal brace minimum. Sway braces shall be constructed in accordance with the drawings. Branch lines, walls, or floors shall not be used as sway braces.

3.8.4 Vertical Runs

Vertical runs of piping shall be braced at not more than 3 m vertical intervals. For tubing, bracing shall be provided at no more than 1.2 m spacing. Vertical braces shall be above the center of gravity of the span being braced. All sway braces shall be constructed in accordance with the drawings. Branch lines, walls, or floors shall not be used as sway braces.

3.8.5 Anchor Rods, Angles, and Bars

Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure on the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

3.8.6 Maximum Length for Anchor Braces

| Type | Size (millimeters) | Maximum length* (meters) | Allowable Loads* (kilonewtons) |
|---|---|---|---|
| Angles | 38 x 38 x 6 | 1.5 | 25.5 |
| | 50 x 50 x 6 | 2.0 | 34.5 |
| | 64 x 38 x 6 | 2.5 | 43.5 |
| | 75 x 64 x 6 | 2.5 | 48.0 |
| | 75 x 75 x 6 | 3.0 | 53.0 |
| Rods | 91 | 1.0 | 16.5 |
| | 22 | 1.0 | 22.0 |
| Flat Bars | 38 x 6 | 0.4 | 14.0 |
| | 50 x 6 | 0.4 | 18.0 |
| | 50 x 10 | 0.5 | 28.5 |
| Pipes (40s) | 25 | 2.0 | 18.0 |
| | 32 | 2.8 | 24.5 |
| | 40 | 3.2 | 29.5 |
| | 50 | 4.0 | 39.5 |

*Based on the slenderness ratio of l/r = 200 and ASTM A 36 steel, where l is the length of the brace and r is the least radius of gyration of the brace.

3.8.7 Clamps and Hangers

Clamps or hangers on uninsulated pipes shall be applied directly to pipe.

Insulated piping shall have clamps or hangers applied over insulation in accordance with Section 15250 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.8.8 Bolts

Bolts used for attachment of anchors to pipe and structure shall be not less than 13 mm diameter.

3.9 SWAY BRACES FOR DUCTS

3.9.1 Braced Ducts

Bracing details and spacing for rectangular and round ducts shall be in accordance with SMACNA-12, including Appendix E, using Seismic Hazard Level C.

3.9.2 Unbraced Ducts

Hangers for unbraced ducts shall be positively attached to the duct within 50 mm of the top of the duct with a minimum of two #10 sheet metal screws. Unbraced ducts shall be installed with a 150 mm minimum clearance to vertical ceiling hanger wires.

3.10 SWAY BRACES FOR CONDUIT

Conduit shall be braced as for an equivalent weight pipe.

3.11 EMERGENCY GAS SUPPLY CONNECTIONS

Facilities which are to be connected to natural gas distribution systems shall be provided with an aboveground locked, valved and capped emergency gas supply connection. Provisions shall be made for attachment of a portable, commercial-sized gas cylinder system to this connection. Connection shall be located within 300 mm of the exterior wall and clearly marked with an appropriate metal sign mounted on wall above. An automatic device to safely interrupt the flow of gas to the building in case of an earthquake shall be installed in accordance with ANSI Z21.70, in addition to manual shut-off valves as required by section 02685 GAS DISTRIBUTION SYSTEM.

3.12 EQUIPMENT SWAY BRACING

3.12.1 Suspended Equipment

Equipment sway bracing shall be provided for items supported from overhead floor or roof structures. Braces shall consist of angles, rods, wire rope, bars, or pipes arranged as shown and secured at both ends with not less than 13 mm bolts. Braces shall conform to paragraph Maximum Length for Anchor Braces. Sufficient braces shall be provided for equipment to resist a horizontal force equal to 0.56 times the weight of equipment without exceeding safe working stress of bracing components. Details of equipment bracing shall be submitted for approval. In lieu of bracing with vertical supports, these items may be supported with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

3.12.2 Floor or Pad Mounted Equipment

3.12.2.1 Shear Resistance

Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph ANCHOR BOLTS.

3.12.2.2 Overturning Resistance

The ratio of the height of the equipment (measured from the base to the center of gravity of the equipment) to the minimum distance between anchor bolts shall be used to determine if overturning forces need to be considered in the sizing of anchor bolts. If this ratio is greater than 4.44 the bolt values in paragraph Minimum Bolt Sizes, Cast-In-Place Anchor Bolts shall not be used and calculations shall be provided to verify the adequacy of the anchor bolts for combined shear and overturning.

3.13 MISCELLANEOUS EQUIPMENT

3.13.1 Rigidly Mounted Equipment

The following specific items of equipment to be furnished under this contract shall be constructed and assembled to withstand a horizontal lateral force of 0.11 times the operating weight of the equipment, at vertical center of gravity of the equipment without causing permanent deformation, dislocations, separation of components, or other damage, which would render the equipment inoperative for significant periods of time following an earthquake.

Rigidly Mounted Equipment

Boilers
Chillers
Air-Handling Units

Substations
Transformers
Switch Boards and Switch Gears
Motor Control Centers
Free Standing Electric Motors
Surge Tanks

3.13.2 Nonrigid or Flexibly-Mounted Equipment

The following specific items of equipment to be furnished shall be constructed and assembled to resist a horizontal lateral force of .56 times the operating weight of the equipment at the vertical center of gravity of the equipment.

3.14 LIGHTING FIXTURES IN BUILDINGS

Lighting fixtures and supports shall conform to the following:

3.14.1 Pendant Fixtures

Loop and hook or swivel hanger assemblies for pendant fixtures shall be

fitted with a restraining device to hold the stem in the support position during earthquake motions. Pendant-supported fluorescent fixtures shall also be provided with a flexible hanger device at the attachment to the fixture channel to preclude breaking of the support. The motion of swivels or hinged joints shall not cause sharp bends in conductors or damage to insulation.

3.14.2 Recessed Fluorescent Fixtures

Recessed fluorescent individual or continuous-row mounted fixtures shall be supported by a seismic-resistant suspended ceiling support system and shall be fastened thereto at each corner of the fixture with bolts or approved clips; or shall be provided with fixture support wires attached to the building structural members using two wires for individual fixtures, attached to opposite corners, and one wire per unit of continuous row mounted fixtures. Each wire support shall be capable of supporting four times the weight of the fixture. Recessed lighting fixtures not over 25 kg in weight and suspended or pendant-hung fixtures not over 10 kg in weight may be supported by and attached directly to the ceiling system runners by a positive attachment such as screws or bolts, number and size as required by design seismic zone.

3.14.3 Assembly Mounted on Outlet Box

A supporting assembly that is intended to be mounted on an outlet box shall be designed to accommodate mounting features on 100 mm boxes, 75 mm plaster rings, and fixture studs.

3.14.4 Surface-Mounted Fluorescent Fixtures

Surface-mounted fluorescent individual or continuous-row fixtures shall be attached to a seismic-resistant ceiling support system. Fixture support devices for attaching to suspended ceilings shall be a locking-type scissor clamp or a full loop band that will securely attach to the ceiling support. Fixtures attached to underside of a structural slab shall be properly anchored to the slab at each corner of the fixture.

3.14.5 Wall-Mounted Emergency Light Unit

Each wall-mounted emergency light unit shall be secured to remain in place during a seismic disturbance.

3.14.6 Lateral Force

Light fixture bracing shall be designed to resist a lateral force of 0.56 times the fixture weight.

3.15 SUSPENDED CEILING ASSEMBLIES

The structural members of ceiling support systems, used primarily to support acoustical tile panels or acoustical panel lay-in tiles, with or without lighting fixtures, ceiling-mounted air terminals, and ceiling-mounted services, shall conform to the following:

3.15.1 Design Loads

The main runners and cross-runners and their splices and intersection connections shall be designed for two times the design load or ultimate axial tension or compression (minimum 550 N. The connections at the splices

and intersections shall be of a mechanical interlocking type that cannot easily be disengaged. Ceiling structural systems shall be designed to withstand required vertical load as well as a lateral force of 11.3 percent of the ceiling weight. The ceiling weight shall include all lighting fixtures and other equipment that are laterally supported by the ceiling and shall be not less than 200 Pa. Exception: Ceiling areas of 13 square meters or less surrounded by walls that connect directly to the structure above will be exempt from the lateral-load standards of this specification.

3.15.2 Installation Requirements
Installation requirements shall be in accordance with ASTM E 580 except as follows:

3.15.2.1 Vertical Support

Hanger wires supporting a maximum tributary ceiling area of 1.5 square meters shall be a minimum of 10 gauge in diameter. The size of wires supporting a tributary ceiling area greater than 1.5 square meters shall be substantiated by design calculations. Hanger attachment devices used in ceiling systems not exceeding 200 Pa shall be capable of supporting a minimum allowable load of 1.3 kN. Hanger attachment devices used in ceiling systems exceeding 200 Pa shall be capable of supporting the design load and shall be substantiated by design calculations. If hangers must be splayed more than one horizontal to six vertical, the resulting horizontal force shall be offset by bracing or counter-splaying, and substantiated by design calculations.

3.15.2.2 Lateral Support

In lieu of the design criteria stated above, where ceiling loads do not exceed 200 Pa, lateral support for the ceiling system may be provided by four galvanized wires of minimum No. 12 gauge, as indicated in ASTM E 580, paragraph 4.4.6.

3.15.3 Lighting Fixture and Air Diffuser Supports

Lighting fixture and air diffuser supports shall be designed and installed to meet the requirements of equipment supports in the preceding paragraphs of this specification with the following exceptions:

a. Recessed lighting fixtures not over 25 kg in weight and suspended and pendent-hung fixtures not over 10 kg in weight may be supported and attached directly to the ceiling system runners by a positive attachment such as screws or bolts.

b. Air diffusers that weigh not more than 10 kg and that receive no tributary loading from ductwork may be positively attached to and supported by the ceiling runners.

-- End of Section --

SECTION 13814

# BUILDING PREPARATION FOR ENERGY MONITORING AND CONTROL SYSTEMS (EMCS)

## 1.1 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

| | |
|---|---|
| ANSI C12.1 | (1988) Code for Electricity Metering |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|---|---|
| ASME-18 | (1971; Int. Supple 19.5-1972; Errata 1974) Fluid Meters, Their Theory and Application |

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

| | |
|---|---|
| IEEE C57.13 | (1993) Instrument Transformers |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

| | |
|---|---|
| NEMA 250 | (1991) Enclosures for Electrical Equipment (1000 Volts Maximum) |
| NEMA ICS 1 | (1993) Industrial Controls and Systems |

## 1.2 GENERAL REQUIREMENTS

### 1.2.1 Preparation of Building for Interface

The Contractor shall provide all services, materials, and equipment necessary to prepare the building for interface to a future EMCS.

### 1.2.2 Environmental Conditions

All equipment shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered at the installed location.

## 1.3 SUBMITTALS

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

SD-01 Data

Equipment and Performance; FIO.

Six copies of the hardware and maintenance data, in manual format, bound in hardback, loose-leaf binders, within 30 days after completing the site testing. The contents of each manual shall be identified on the cover. The manuals shall include the names, addresses, and telephone numbers of each subcontractor installing equipment and systems, and of the nearest service representatives for each item of equipment and each system. The manuals shall have a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies, to be submitted after completion of the site test, shall include all modifications made during installation, checkout, and acceptance.

Hardware data, shall describe all equipment provided, including:

a. General description and specifications.

b. Installation and checkout procedures.

c. Electrical schematics and layout drawings.

d. Alignment and calibration procedures.

e. Manufacturer's repair parts list indicating sources of supply, and National Stock Number when obtainable from the manufacturer.

f. Interface definition.

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

SD-04 Drawings

Equipment and Material; FIO.

Detail drawings consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall contain complete wiring, routing, and schematic diagrams. Drawings shall show proposed layout and installation of all equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-08 Statements

Test Plan; GA.

Six copies of test plan and test procedure. Six copies of test report that documents the test results, in booklet form. Test plan documents for the test, 120 days prior to the test. The test plan shall define all the tests required to ensure that the equipment meets technical and performance specifications. The test plan shall define milestones for the test exercises and shall identify the capabilities and functions to be tested.

Test Procedure; FIO.

Test procedure documents, 60 days prior to the test. Test

procedures shall be developed from the test plans and design documentation. The procedures shall consist of detailed instructions for test setup, execution, and evaluation of test results. The procedures shall explain and shall detail, step by step, actions and expected results to demonstrate the requirements of this specification and the methods for simulating the necessary conditions of operation to demonstrate performance of the equipment. All test equipment to be used shall be furnished by the Contractor.

SD-09 Reports

Site Testing; FIO.

Test report, within 15 days after completion of the test. The test report shall be used to document results of the test.

## 2.1 STANDARD PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Units of the same type of equipment shall be products of a single manufacturer.

## 2.2 ENCLOSURES

Enclosures shall conform to the requirements of NEMA 250 for the types specified. Finish color shall be the manufacturer's standard, unless otherwise indicated. Damaged surfaces shall be repaired and refinished using original type finish. Enclosures installed indoors shall be Type 12, or as shown. Equipment installed outdoors shall be housed in a Type 4 enclosure, unless otherwise shown.

## 2.3 NAMEPLATES

Laminated plastic nameplates shall be provided for all equipment furnished. Each nameplate shall identify the function, such as "mixed air controller" or "cold deck temperature sensor." Laminated plastic shall be 3 mm thick, white with black center core. Nameplates shall be a minimum of 25 by 75 mm, with minimum 6 mm high engraved block lettering. Nameplates for devices smaller than 25 by 75 mm shall be attached by a nonferrous metal chain. All other nameplates shall be attached to the equipment.

## 2.4 INSTRUMENTATION AND CONTROL (I&C) DIAGRAMS

Framed mylar drawings in laminated plastic shall be provided. Drawings shall show complete I&C diagrams for all equipment furnished and interfaces to all existing equipment, at each respective equipment location. 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 manually shall be prepared in typed form, framed as specified for the I&C diagrams and posted beside the diagrams. Proposed diagrams, instructions, and other sheets shall be submitted prior to posting. The instructions shall be posted after completion of the Contractor's site testing. Provide a mylar reproducible of each I&C diagram in addition to the posted copy.

## 2.5 DATA TERMINAL CABINET (DTC)

Data terminal cabinet shall be provided for each mechanical room as an interface to the data environment (DE) instrumentation and controls. No instrumentation and control devices shall be located within the DTC.

2.5.1 Enclosure

The DTC shall be a separate metallic enclosure. The DTC shall be sized to accommodate the number of functions required by the control and monitoring devices as shown plus 25 percent expansion for each type of function provided.

2.5.2 Groupings

The DTC shall be divided into analog and digital groupings, each with separate sensor and control signal wiring raceways.

2.5.3 Terminal Strips

The DTC shall be provided with double sided screw type terminal strips. One side of the terminal strip shall be used for termination of field wiring from instrumentation and controls. The other side shall be used to connect the DTC to the future FID or MUX. Terminal strips shall have individual terminal identification numbers.

2.5.4 Power

A 120-Vac, 15-A, 60 Hz duplex outlet shall be provided within 1.8 m of each DTC.

2.6 INSTRUMENTATION AND CONTROL

2.6.1 Temperature Instruments

2.6.1.1 Resistor Temperature Detector (RTD)

RTDs shall be platinum with an accuracy of plus or minus 0.1 percent at 0.0 degrees C and shall be encapsulated in epoxy, series 300 stainless steel, anodized aluminum, or copper. Each RTD shall be furnished with an RTD transmitter specified and mounted integrally, unless otherwise shown.

2.6.1.2 Resistor Temperature Detector (RTD) Transmitters

The RTD transmitter shall be selected to match the resistance range of the platinum RTD. The transmitter shall produce a linear 4 to 20 mAdc output corresponding to the required temperature span. The output error shall not exceed 0.1 percent of calibrated span. The transmitter shall include offset and span adjustments unless the RTD element is integral to the transmitter and system calibration is provided.

2.6.1.3 Continuous Averaging RTDs

Continuous averaging RTDs shall have an accuracy of plus or minus 0.6 degree C at the reference temperature, and shall be of sufficient length to ensure that the resistance represents an average over the cross section in which it is installed. The sensor shall have a bendable copper sheath. Each averaging RTD shall be furnished with an RTD transmitter selected to match the resistance range of the averaging RTD. The transmitter shall produce a linear 4 to 20 mAdc output corresponding to

the required temperature span. The output error of the transmitter shall not exceed 0.1 percent of the calibrated span. The transmitter shall include offset and span adjustments.

2.6.1.4 Temperature Switches

Temperature switches shall have a repetitive accuracy of plus or minus 1 percent of the operating ranges shown. Switch actuation shall be adjustable over the operating temperature range. The switch shall have a snap-action Form C contact rated for the application.

2.6.1.5 Thermowells

Thermowells shall be monel, brass, or copper for use in copper water lines, wrought iron for measuring flue gases, and series 300 stainless steel for all other applications. The thermowell shall include a connection box, sized to accommodate the temperature transmitter.

2.6.1.6 Instrument Shelters

Instrument shelters shall be fabricated from wood and painted white. Shelters shall have louvered sides, double tops, and slotted bottoms.

2.6.2 Relative Humidity Sensors

Relative humidity sensors shall use nonsaturating sensing elements capable of withstanding a saturated condition without permanently affecting calibration or sustaining damage. Sensors shall have a range of 20 to 80 percent, with an accuracy of plus or minus 5 percent of full scale. A transmitter located at the sensor shall be provided to convert the sensor output to a linear 4 to 20 mAdc output corresponding to the required humidity span. The output error shall not exceed 0.1 percent of calibrated span. The transmitter shall include offset and span adjustments.

2.6.3 Pressure Instruments

2.6.3.1 Pressure Transducers

Pressure transducers shall withstand up to 150 percent of rated pressure, with an accuracy of plus or minus 1 percent of full scale. The sensing element shall be either capsule, diaphragm, bellows, bourdon tube, or solid state. A transmitter located at the transducer shall be provided to convert the sensing element output to a linear 4 to 20 mAdc output corresponding to the required pressure span. The output error shall not exceed 0.1 percent of calibrated span. The transmitter shall include offset and span adjustments.

2.6.3.2 Pressure Switches

Pressure switches shall have a repetitive accuracy of plus or minus 5 percent of their operating range and shall withstand up to 150 percent of rated pressure. Sensors shall be diaphragm or bourdon tube. Switch actuation shall be adjustable over the operating pressure range. Switch shall have a snap-action Form C contact rated for the application. Gauge pressure switches shall have an adjustable differential setting.

2.6.4 Flow Instruments

2.6.4.1 Orifice Plates

Orifice plates shall be made of a series 300 stainless steel sheet of 3.2 mm nominal thickness with an accuracy of plus or minus 1 percent of full flow. The orifice plate shall be flat within 25.4 micrometers. The orifice surface roughness shall not exceed 0.5 micrometers. The thickness of the cylindrical face of the orifice shall not exceed 1/50 of the pipe inside diameter or 1/8 of the orifice diameter, whichever is smaller. The upstream edge of the orifice shall be square and sharp.

2.6.4.2 Flow Nozzles

Flow nozzles shall be made of series 300 stainless steel with an accuracy of plus or minus 1 percent of full flow. The inlet nozzle form shall be elliptical and the nozzle throat shall be the quadrant of an ellipse. The thickness of the nozzle wall and flange shall be such that distortion of the nozzle throat from strains caused by the pipeline temperature and pressure, flange bolting, or other methods of installing the nozzle in the pipeline shall not cause the accuracy to degrade beyond the specified limit. The outside diameter of the nozzle flange or the design of the flange facing shall be such that the nozzle throat shall be centered accurately in the pipe.

2.6.4.3 Venturi Tubes

Venturi tubes shall be made of cast-iron or cast-steel and shall have an accuracy of plus or minus 1 percent of full flow. The throat section shall be lined with series 300 stainless steel. Thermal expansion characteristics of the lining shall be the same as that of the throat casting material. The surface of the throat lining shall be machined to a 1.3 micrometers finish, including the short curvature eading from the converging entrance section into the throat.

2.6.4.4 Annular Pitot Tubes

Annular pitot tubes shall be averaging type differential pressure sensors with four total head pressure ports and one static port made of series 300 stainless steel. Sensor shall have an accuracy of plus of minus 2 percent of full flow.

2.6.4.5 Turbine Meters

Turbine meters shall be series 300 stainless steel with an accuracy of plus or minus 1 percent from 30 to 100 percent of actual flow. Turbine flowmeters shall consist of two components, a turbine and an electronic transmitter. The turbine shall measure the flow, and the electronic transmitter shall produce a linear analog output of 4 to 20 mAdc corresponding to the required flow span. The transmitter shall include offset and span adjustments.

2.6.4.6 Vortex Shedding Flowmeters

The vortex flowmeter shall produce an analog 4 to 20 mAdc signal that is linearly proportional to the volumetric flow rate. The accuracy shall be within plus or minus 0.8 percent of the actual flow. The electronic transmitter for the vortex flowmeter shall allow either internal or external mounting, within 15 m of the flow sensor. The flowmeter body shall be made of series 300 stainless steel.

2.6.4.7 Flow Switches

Flow switches shall have a repetitive accuracy of plus or minus 1 percent of its operating range. Switch actuation shall be adjustable over the operating flow range. The switch shall have a snap-action Form C contact rated for the application.

2.6.5 Electric Power Instruments

2.6.5.1 Potential Transformers

Potential transformers shall conform to IEEE C57.13.

2.6.5.2 Current Transformers

Current transformers shall conform to IEEE C57.13.

2.6.5.3 Meters and Meter Sockets

Meters in kjoule and meter sockets shall conform to ANSI C12.1. Meters shall have pulse initiators for remote monitoring ofwatthour consumption. Pulse initiator shall consist of Form C contacts with a current rating not to exceed 2 amperes and voltage not to exceed 500 volts, with combinations of VA not to exceed 100 VA, and a life rating of one billion operations.

2.6.5.4 Meters with Demand Register

Meters in kjoule with demand register and meter sockets shall conform to ANSI C12.1. Meters shall have pulse initiators for remote monitoring of watthour consumption and instantaneous demand. Pulse initiators shall consist of Form C contacts with a current rating not to exceed 2 amperes and voltage not to exceed 500 volts, with combinations of VA not to exceed 100 VA, and a life rating of one billion operations.

2.6.5.5 Transducers

Transducers in kjoule (Watthour) shall have an accuracy of plus or minus 0.25 percent for outputs from full lag to full lead power factor. Input ranges for transducers shall be selectable without requiring the changing of current or potential transformers. The output shall be 4 to 20 mAdc.

2.6.5.6 Current Sensing Relays

Current sensing relays shall be of a design that provides a normally-open (NO) single-pole, single-throw (SPST) contact rated at a minimum of 50 volts peak and one-half ampere or 25 VA, noninductive. Current sensing relays shall be single unit construction with provisions for firm mounting. They have a single hole for passage of current carrying conductors and sized for operation at a nominal 50 percent of current rating of sensed device. The Contractor shall use multiple turns of sensed leads for higher rate loads. Voltage isolation shall be for a minimum of 600 volts.

2.6.6 Omitted

2.6.7 Output Devices

2.6.7.1 Control Relays

Control relay contacts shall be rated for the application, with a minimum of 2 sets of Form C contacts enclosed in a dust-proof enclosure. Relays shall be rated for a minimum life of one million mechanical operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

2.6.7.2 Time Delay Relays

Time delay relay contacts shall be rated for the application with a minimum of 2 sets of Form C contacts enclosed in a dust-proof enclosure. Relays shall be rated for a minimum life of one million mechanical operations. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage. Delayed contact opening or closing shall be adjustable from 1 to 60 seconds with a minimum accuracy of plus or minus 2 percent of setting.

2.6.7.3 Latching Relays

Latching relay contacts shall be rated for the application with a minimum of 2 sets of Form C contacts enclosed in a dust-proof enclosure. Relays shall be rated for a minimum life of one million mechanical operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

2.6.7.4 Reed Relays

Reed relays shall be encapsulated in a container housed in a plastic, epoxy, or metal case. Contacts shall be rated for the application. Operating and release times shall be 1 millisecond or less. Relays shall be rated for a minimum life of 10 million mechanical operations and shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

2.6.7.5 Contactors

Contactors shall be of the single coil, electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semipermanent magnets. Contacts shall be double-break silver-to-silver type protected by arcing contacts where necessary. Number of contacts and ratings shall be selected for the application. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices to limit transients to 150 percent of rated coil voltage.

2.6.7.6 Solid State Relays

Input-output isolation shall be greater than 1000 megohms with a breakdown voltage of 1500 volts root mean square or greater at 60 Hz. Relays shall be rated for a minimum life of 10 million operations. The ambient temperature range shall be at least minus 28.9 degrees C to plus 60.0 degrees C. Input impedance shall not be less than 500 ohms. Relays shall be rated for the application. Operating and release times shall be 1 millisecond or less. Transients shall be limited to 150 percent of control voltage. Solid state relays shall not be used on inductive loads which are

switched on-off.

2.6.7.7 Electric Solenoid Operated Pneumatic (EP) Valve

EP valves shall have three port operations: common, normally open, and normally closed. EP valves shall have an outer cast aluminum body with internal parts constructed of brass, bronze, or stainless steel. The air connection shall be a 10 mm NPT threaded connection. EP valves shall be rated for 344 kPa when used in control system operation at 172 kPa or less, or rated at 1 MPa when used in control system operation from 172 to 690 kPa. EP coils shall be equipped with transient suppression o limit transients to 150 percent of rated voltage. EP valve operation hall be rated for a minimum of 104 degrees C.

2.6.7.8 Single Input Control Point Adjustment (CPA) Controller

Single input CPA controllers shall permit changing of control points remotely by varying the CPA port value. CPA shall be plus or minus 10 percent of primary sensor span. Controllers shall operate from electronic or pneumatic sensors as shown. Controllers shall be complete with adjustable setpoint, adjustable gain (proportional band), and shall be field selectable for direct or reverse action. Pneumatic units provided shall be constructed to withstand a maximum pressure of 172 kPa. All controller inputs and outputs shall be provided with internal or external gauges or meters for calibration of input and output signals.

2.6.7.9 Dual Input Controller

Dual input controllers shall permit changing of control points remotely by varying the second port input value. Controllers shall operate from electronic or pneumatic sensors as shown. Controllers shall be complete with adjustable setpoint, adjustable gain (proportional band), adjustable authority, and shall be field selectable for direct or reverse action. Authority effect of secondary sensor on setpoint shall be adjustable from 33 to 100 percent of primary sensor span. Pneumatic units provided shall be constructed to withstand a maximum pressure of 172 kPa. All controller inputs and outputs shall be provided with internal or external gauges or meters for calibration of input and output signals.

2.6.7.10 Electric to Pneumatic (EP) Transducers

EP transducers shall be matched to a signal of 4 to 20 mAdc and have linearly proportional pneumatic output compatible with the pneumatic control loop to be interfaced. The EP transducer shall have pressure calibration adjustments and shall withstand pressures at least 150 percent of the maximum range. The pneumatic output shall be linearly proportional within 1 percent of the electric input. Transducers shall have offset and span adjustment capabilities. EP transducers shall be rated for zero to minus 17.8 degrees C to plus 60.0 degrees C continuous operation. The body shall be cast aluminum with internal parts constructed of brass, bronze, or stainless steel.

2.6.7.11 Motorized Potentiometers

Motorized potentiometers shall be reversible brushless alnico or samarium cobalt permanent magnet dc motors with rotary potentiometers coupled to the motor or gearhead output shaft. Motors shall be 22 mm diameter or larger, with a minimum rated life of 1,000 perating hours or 200,000 revolutions. Motors shall accept signals for lockwise rotation and counterclockwise

rotation. With no signal present, he motor shall remain stationary. Rotary potentiometers shall be wirewound or conductive plastic, single or multiturn potentiometers with a minimum rated life of 200,000 revolutions. Potentiometers shall have a aximum resistance tolerance of plus or minus 10 percent and a maximum linearity tolerance of plus or minus 1 percent. Potentiometers shall be rated for a minimum of 1 watt at 52 degrees C. Motorized potentiometers shall be housed in enclosures meeting both NEMA Type 4 and NEMA Type 13 ratings, and shall be suitable for operation at ambient temperatures of 1.7 degrees C to 48.9 degrees C.

2.6.7.12 Potentiometer to Current Transducers

Potentiometer to current transducers shall have an accuracy of plus or minus 0.1 percent of span for 3-wire potentiometer inputs between 100 and 10,000 ohms full scale. Potentiometer transducers shall provide continuous span adjustments between 75 and 100 percent of the input range and continuous zero offset adjustment between 0 and 10 percent of the input range. Potentiometer transducers shall provide excitation current to the potentiometer and shall drive a 4 to 20 mAdc output signal, with 500 volts peak to peak isolation between input and output terminals. Potentiometer transducers shall be suitable for operation at ambient temperatures of minus 28.9 degrees C to plus 79.4 degrees C.

2.6.8 Position Sensors

2.6.8.1 End (Limit) Switches

Limit switches shall be of the sealed or enclosed type as required for the application. Contacts shall be snap-action Form C rated for the application.

2.6.8.2 Potentiometers

Potentiometers may be either rotary or linear, depending on the application of each position indicator. Position potentiometers shall have a linearity of plus or minus 5 percent and shall indicate position on a percent open basis.

2.6.9 Key Operated Switches

Hand-off-automatic (HOA), off-automatic, and all similar-use switches shall be key operated with all switches keyed alike. All switches shall be rated for a minimum of 600 Vac, 5-A, and shall be mounted in an enclosure as specified or shown. An auxiliary set of contacts rated for at least 120 Vac, 1 ampere shall be provided with each switch.

2.7 WIRE AND CABLE

The Contractor shall provide all wire and cable from the sensors and control devices in the DE to the DTCs.

2.7.1 Control Wiring

2.7.1.1 Digital Functions

Control wiring for digital functions shall be No. 18 AWG minimum with 600-volt insulation. Multiconductor wire shall have an outer jacket of Polyvinyl Chloride (PVC).

2.7.1.2 Analog Functions

Control wiring for analog functions shall be No. 18 AWG minimum with 600-volt insulation, twisted and shielded, 2-, 3-, or 4-wire to match analog function hardware. Multiconductor wire shall have an outer jacket of PVC.

2.7.2 Sensor Wiring

Sensor wiring shall be No. 20 AWG minimum twisted and shielded, 2-, 3-, 4-wire to match analog function hardware. Multiconductor wire shall have an outer jacket of PVC.

2.7.3 Class 2 Low Energy Conductors

The conductor types and sizes specified for digital and analog functions shall take precedence over any requirements for Class 2 low energy remote control and signal circuit conductors specified elsewhere.

2.8 RACEWAY SYSTEMS

Raceway systems from the sensors and control devices in the DE to the DTCs shall be provided by the Contractor.

3.1 GENERAL INSTALLATION REQUIREMENTS

The Contractor shall install all components and appurtenances in accordance with the manufacturer's instructions and as shown or specified. All necessary interconnections, services, and adjustments required to prepare the building for interface to an EMCS shall be furnished. All wiring, including low voltage wiring, shall be installed in metallic raceways. All other electrical work shall be in accordance with Division 16 of specifications and as shown. Instrumentation grounding as necessary to preclude ground loops and noise from adversely affecting equipment operations shall be installed.

3.2 I/O SUMMARY TABLES

I/O Summary Tables shall be used in conjunction with the drawings to identify the hardware required for each building and system.

3.3 EQUIPMENT INSTALLATION

3.3.1 Temperature Instruments

3.3.1.1 Resistor Temperature Detector (RTD)

When the RTD is installed in pipes or is susceptible to corrosion and vibration, the RTD shall be installed in a thermowell. RTDs which are attached to surfaces shall be clamped or bonded in place. The surface shall be thoroughly cleaned, degreased, and after RTD installation, shall be insulated from ambient temperature effects. RTDs used for space temperature sensing shall include a housing suitable for wall mounting. RTDs used for OA sensing shall have an instrument shelter to minimize solar effects, and shall be mounted to minimize building effects. RTD assemblies shall be readily accessible and installed in a manner as to allow easy replacement.

3.3.1.2 Temperature Switches

Temperature switches shall be installed as specified for RTDs. Temperature switches shall be adjusted to the proper setpoint and shall be verified by calibration. Switch contact ratings and duty shall be selected in accordance with NEMA ICS 1.

3.3.2 Relative Humidity Sensors

Relative humidity sensors shall have air guards when installed in air flows of more than 50 feet per minute across the sensor element.

3.3.3 Pressure Instruments

3.3.3.1 Pressure Sensors

Pressure sensors (all types) installed on liquid lines shall have drains. Pressure sensors installed on steam lines shall have drains and siphons. All pressure sensors shall have valves for isolation, venting, and taps for calibration. Pressure sensors shall be verified by calibration. Differential pressure sensors shall have nulling valves.

3.3.3.2 Pressure Switches

Pressure switches (all types) installed on liquid lines shall have drains. Pressure sensors installed on steam lines shall have drains and siphons. All pressure switches in water and steam lines shall have valves for isolation, venting, and taps for calibration. Pressure switches shall be adjusted to the proper setpoint, and shall be verified by calibration. Pressure switches shall be mounted higher than the process connection. Differential pressure switches shall have nulling valves. Switch contact ratings and duty shall be selected in accordance with NEMA ICS 1.

3.3.4 Flow Instruments

3.3.4.1 Flowmeters

Flowmeters shall be installed in accordance with ASME-18.

3.3.4.2 Orifice Plates

Orifice plates shall be located in horizontal pipe runs. For liquid measurement, the orifice plate flanges shall be installed so that the pressure taps are in the horizontal plane with the centerline of the pipe. For gas measurement, the orifice plate flanges shall be installed so that the pressure taps are 45 degrees or more above the horizontal plane with the centerline of the pipe. For steam measurement, eccentric orifice plate flanges shall be installed so that the pressure taps are 45 degrees below, or in the horizontal plane with the centerline of the pipe. Orifice plates shall be installed for ease of accessibility for periodic maintenance. The differential pressure sensors shall be as close to the orifice plates as possible. For gas measurement the required differential pressure transmitter shall be physically installed above the orifice taps. For steam, the required differential pressure transmitter shall be physically installed a minimum of 200 mm below the taps. For liquid, the differential pressure transmitter shall be installed below the orifice tops.

3.3.4.3 Flow Nozzles

Flow nozzles shall be installed in horizontal pipe runs with flanges installed so that the pressure taps are in a horizontal plane with the centerline of the pipe. Flow nozzles shall be installed for ease of accessibility for periodic maintenance. The differential pressure sensors shall be installed as close to the flow nozzle as possible.

3.3.4.4 Venturi Tubes

Venturi tubes shall be installed in horizontal pipe runs. Venturi tubes shall be installed so that the pressure tap is in the horizontal plane with the centerline of the pipe. Venturi tubes shall be installed for ease of accessibility for periodic maintenance.

3.3.4.5 Annular Pitot Tubes

Annular pitot tubes shall be installed so that the total head pressure ports are set-in-line with the pipe axis upstream and the static port facing downstream. The total head pressure ports shall extend diametrically across the entire pipe. Annular pitot tubes shall not be used wherever the flow is pulsating or where pipe vibration exists.

3.3.4.6 Turbine Meters

Turbine meters shall be installed so that the sensor is located in the center of the fluid flow pipe on the main axis.

3.3.4.7 Vortex Shedding Flowmeters

The flowmeter shall be installed with its top above the pipeline in horizontal installations. The direction of flow shall be upward in vertical installations. The flowmeter shall be aligned to the direction of the flow, and shall be rigidly mounted and vibration free.

3.3.4.8 Flow Switches

Flow switches shall be installed in such a manner as to minimize any disturbance in the flow of fluid while maintaining reliable operation of the switch.

3.3.5 Electric Power Devices

3.3.5.1 Potential Transformers

Potential transformers shall be installed in new cabinets as shown.

3.3.5.2 Current Transformers

Current transformers shall be installed in new cabinets as shown.

3.3.5.3 Meters

Kilojoule meters shall be installed in new cabinets as shown.

3.3.5.4 Demand Meters

Kilojoule demand meters shall be installed in new cabinets as shown.

3.3.5.5 Transducers

Kilojoule transducers shall be installed in new cabinets as shown.

3.3.5.6 Current Sensing Relays

Relays shall be installed in new cabinets as shown.

3.3.6 Omitted

3.3.7 Output Devices

3.3.7.1 Relays and Contactors

Relays and contactors shall be installed in new cabinets.

3.3.7.2 Electric Solenoid Operated Pneumatic Valve (EP)

EP valves shall be installed in new cabinets.

3.3.7.3 Controllers

Controllers shall be installed in new control cabinets or as shown.

3.3.7.4 Electric to Pneumatic (EP) Transducers

EP transducers shall be installed in new cabinets.

3.3.8 Position Sensors

3.3.8.1 End (Limit) Switch

Limit switch type and mounting shall be properly suited for the application to provide reliable switch operation.

3.3.8.2 Potentiometers

Potentiometer type and mounting shall be properly suited for the application to provide reliable operation.

3.3.9 Instrument Shelters

Instrument shelters shall be installed with the bottom 1.2 m above the supporting surface, using legs, and secured rigidly to minimize vibrations from winds. Instrument shelters shall be oriented facing north.

3.3.10 Enclosures

All enclosure penetrations shall be from the bottom and shall be sealed to preclude entry of water using a silicone rubber sealant.

3.4 SITE TESTING

Site testing and adjustment of all equipment shall be performed in accordance with approved test procedures. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. Test reports shall be submitted as specified.

-- End of Section --