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SECTION 03100

STRUCTURAL CONCRETE FORMWORK

04/01

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SECTION 03100

STRUCTURAL CONCRETE FORMWORK
04/01

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 347R (1994) Guide to Formwork for Concrete

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA ANSI/AHA A135.4 (1995) Basic Hardboard

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard -
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 01330: SUBMITTAL PROCEDURES:

SD-01 Data

Design; FIO.

Design analysis and calculations for form design and methodology used in the design.

Form Materials; FIO.

Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

SD-04 Drawings

Concrete Formwork; FIO.

Drawings showing details of formwork, including dimensions of fiber voids,

joints, supports, studding and shoring, and sequence of form and shoring removal. See SECTION 03300 for additional requirements of formwork drawings.

SD-06 Instructions

Form Releasing Agents; FIO.

Manufacturer's recommendation on method and rate of application of form releasing agents.

1.3 DESIGN

Design and engineering of formwork, shoring and reshoring as well as its construction is the responsibility of the Contractor.

Formwork shall be designed by a Professional Structural Engineer currently registered in the State of Minnesota, having a minimum of 3 years experience in this type of design work and 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.

1.3.1 Design Requirements

Design formwork for loads, lateral pressures and allowable stresses outlined in ACI 347R and for design considerations, wind loads, allowable stresses and other applicable requirements of the controlling local building code. Where conflicts occur between the above two standards, the more stringent requirements shall govern. Design formwork to limit maximum deflection of form facing materials reflected in concrete surfaces exposed to view to 1/240 of span between structural members.

1.3.2 Form Removal

Develop a procedure and schedule for removal of shores and installation of reshores and for calculating the loads transferred to the structure during this process. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon. When developing procedure, schedule and structural calculations, consider the following at each stage of construction: The structural system that exists; effects of all loads during construction; strength of concrete; the influence of deformations of the structure and shoring system on the distribution of dead loads and construction loads; the strength and spacing of shores or shoring systems used, as well as the method of shoring, bracing, shore removal, and reshoring including the minimum time intervals between the various operations; any other loading or condition that affects the safety of serviceability of the structure during construction.

PART 2 PRODUCTS

2.1 FORM MATERIALS

2.1.1 Forms For Class A and Class B Finish (Exposed to View)

Forms for Class A and 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. Use full 4 foot x 8 foot panels unless smaller pieces will cover entire area. Forms for round columns shall be the prefabricated seamless type.

2.1.2 Forms For Class C Finish (Not Exposed to View)

Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA ANSI/AHA A135.4; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used. Forms for round columns may have one vertical seam.

2.1.3 Forms For Class D Finish (Concrete to be covered with soil)

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 Form Ties

Commercially fabricated for use in form construction. Do not use wire ties. Constructed so that ends or end fasteners can be removed without causing spalling at surfaces of the concrete. 3/4 inch minimum to 1 inch maximum diameter cones on both ends. Embedded portion of ties to be not less than 1-1/2 inch from face of concrete after ends have been removed.

2.1.5 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

Install products in accordance with manufacturer's instructions. Make forms sufficiently tight to prevent loss of mortar from concrete. At construction joints, overlap contact surface of form sheathing for flush surfaces exposed to view over hardened concrete in previous placement by at

least 1 inch. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain a true surface. Where possible, locate juncture of built-in-place wood or metal forms at architectural lines, control joints or at construction joints.

Construct wood forms for wall openings to facilitate loosening, if necessary, to counteract swelling. Anchor formwork to shores or other supporting surfaces or members so that movement of any part of formwork system is prevented during concrete placement. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel. Provide positive means of adjustment (wedges or jacks) of shores and struts and take up all settlement during concrete placing operation. Securely brace forms against lateral deflection. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check.

Provide temporary openings at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed, and to limit height of free fall of concrete to prevent aggregate segregation. Temporary openings to limit height of free fall of concrete shall be spaced no more than 8 FT apart. Clean surfaces of forms, reinforcing steel and other embedded materials of any accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed.

3.2 CHAMFERING

Except as otherwise shown, place 3/4 inch chamfer strips in exposed to view corners of forms to produce 3/4 inch wide beveled edges.

3.3 COATING

Forms for Class A and 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 preventing injury to the concrete and ensuring 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. Supporting forms or shores shall not be removed before the concrete strength has reached 70 percent of design strength, 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.

3.5 TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:
 - a. In the lines and surfaces of columns, piers, walls and in arises

| | |
|---------------------------------|----------|
| In any 10 feet of length ----- | 1/4 inch |
| Maximum for entire length ----- | 1/2 inch |
 - b. For exposed corner columns, control-joint grooves, and other conspicuous lines

| | |
|--------------------------------|----------|
| In any 20 feet of length ----- | 1/4 inch |
| Maximum for entire length----- | 1/2 inch |

2. Variation from the level or from the grades indicated on the drawings:
 - a. In slab soffits, ceilings, beam soffits, and in arises, measured before removal of supporting shores

| | |
|--|----------|
| In any 10 feet of length ----- | 1/4 inch |
| In any bay or in any 20 feet of length ----- | 3/8 inch |
| Maximum for entire length ----- | 3/4 inch |
 - b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines

| | |
|--|----------|
| In any bay or in any 20 feet of length ----- | 1/4 inch |
| Maximum for entire length----- | 1/2 inch |

3. Variation of the linear building lines from established position in plan

| | |
|----------------------|----------|
| In any 20 feet ----- | 1/2 inch |
| Maximum ----- | 1 inch |

4. Variation of distance between walls, columns, partitions

| |
|---|
| 1/4 inch per 10 feet of distance, but not more than 1/2 inch in any one bay, and not more than 1/2 inch |
|---|

total variation

- 5. Variation in the sizes and locations of sleeves, floor openings, and wall opening
 - Minus ----- 1/4 inch
 - Plus ----- 1/2 inch

- 6. Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls
 - Minus ----- 1/4 inch
 - Plus ----- 1/2 inch

- 7. Footings:
 - a. Variation of dimensions in plan
 - Minus ----- 1/2 inch
 - Plus ----- 2 inches
 - when formed or plus 3 inches
 - when placed against unformed excavation

 - b. Misplacement of eccentricity
 - 2 percent of the footing width in the direction of misplacement but not more than 2 inches

 - c. Reduction in thickness of specified thickness
 - Minus ----- 5 percent
 - Plus ---- No limit except that which may interfere with other construction

- 8. Variation in steps:
 - a. In a flight of stairs
 - Riser ----- 1/8 inch
 - Tread ----- 1/4 inch

 - b. In consecutive steps
 - Riser ----- 1/16 inch
 - Tread ----- 1/8 inch

Establish and maintain in an undisturbed condition and until final completion and acceptance of Project, sufficient control points and bench marks to be used for reference purposes to check tolerances. Regardless of tolerances listed allow no portion of structure to extend beyond legal boundary of Project. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork prior to hardening of concrete.

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SECTION 03150

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SECTION 03150

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

04/01

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 920 | (1995) Elastomeric Joint Sealants |
| ASTM D 378 | (1991) Rubber Belting, Flat Type |
| ASTM D 380 | (1994) Methods of Testing Rubber Hose |
| ASTM D 395 | (1994) Test Method for Rubber Property -Compression Set |
| ASTM D 412 | (1992) Test Method for Rubber Properties in Tension |
| ASTM D 471 | (1996) Rubber Property - Effect of Liquids |
| ASTM D 573 | (1994) Test Method for Rubber - Determination in Air Oven |
| ASTM D 994 | Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type) |
| ASTM D 1056 | Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber |
| ASTM D 1149 | (1991) Test Method for Rubber Property - Young's Modulus at Normal & Abnormal Temperatures |
| ASTM D 1190 | (1996) Concrete Joint Sealer, Hot-Applied Elastic Type Joint Sealers |
| ASTM D 1191 | (1984) Test Methods for Concrete Joint Sealers |

| | |
|-------------|---|
| ASTM D 1751 | (1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) |
| ASTM D 1752 | (1984; R 1996) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction |
| ASTM D 2240 | (1991) Test Method for Rubber Property - Durometer |
| ASTM D 5249 | (1995) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints |

CORPS OF ENGINEERS (COE)

| | |
|---------------|--|
| COE CRD-C 513 | (1974) Corps of Engineers Specifications for Rubber Waterstops |
| COE CRD-C 572 | (1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop |

1.2 SUBMITTALS

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

SD-01 Data

Preformed Expansion Joint Filler; GA. Sealant; GA. Waterstops; GA.

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); and waterstops.

SD-04 Drawings

Waterstops; FIO.

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

SD-06 Instructions

Preformed Expansion Joint Filler; FIO. Sealant; FIO. Waterstops; FIO.

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

splicing non-metallic waterstops.

SD-13 Certificates

Preformed Expansion Joint Filler; FIO. Sealant; FIO. Waterstops; FIO.

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

SD-14 Samples

Field-Molded Type; GA.

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

Non-metallic Materials; GA.

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

1.3 DELIVERY AND STORAGE

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

PART 2 PRODUCTS

2.1 PREFORMED EXPANSION JOINT FILLER

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

2.1.1 Neoprene Expansion Joint Fillers

Materials: closed cell neoprene. ASTM D 1056, Class SC, 2 to 5 psi compression deflection, Grade SCE-41.

2.1.2 Asphalt Expansion Joint Fillers

Materials: ASTM D 994.

2.1.3 Fiber Expansion Joint Fillers

Materials: ASTM D 1751.

2.2 SEALANT

Joint sealant shall conform to the following:

2.2.1 Joint Sealant

Elastomeric (non-bituminous, gray, single-component polyurethane-type):
ASTM C 920, Type S, Grade P for horizontal joints, Grade NS for vertical joints, Class 25 and use as required per paragraph 5 of ASTM C 920.

2.2.2 Hot-Poured Type (for slabs on grade)

ASTM D 1190 tested in accordance with ASTM D 1191.

2.2.3 Field-Molded Type

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

2.3 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated, leaving only straight butt splices for the field.

2.3.1 Rubber Belting for Type A Expansion Joint

The rubber reinforced belting incorporated in this joint shall be similar to that used for conveyor and machine belting meeting the requirements of ASTM D 380

2.3.2 Non-Metallic Materials`

2.3.2.1 PVC Waterstops

PVC waterstops shall be manufactured from virgin polyvinyl chloride compound not containing any scrap or reclaimed materials or pigment. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Polyvinylchloride (PVC) waterstops shall conform to COE CRD-C 572. Rubber waterstops shall conform to COE CRD-C 513. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

2.3.2.2 Expansion Joints

Materials: In expansion joints: 9 inch wide x 3/8 inch thick tear web type waterstop. 2 inch minimum horizontal movement without rupturing. Similar

to Greenstreak Plastic Products Style #700. In all other joints: 6 inch wide x 3/8 inch thick bulb type. Provide hog rings or grommets at maximum 12 inch OC along the length of the waterstop.

2.3.3 Non-Metallic Hydrophilic

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D 412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum.

Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 70 degrees F shall be 3 to 1 minimum.

PART 3 EXECUTION

3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

3.1.1 General - Construction Joints

Locate joints as indicated on Contract Drawings or as shown on approved shop drawings. Unplanned construction joints will not be allowed. If concrete cannot be completely placed between planned construction joints, then it must be removed. In general, locate joints near middle of spans of slabs, beams and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice the width of the beam. Locate joints in walls and columns at underside of floors, slabs, beams, or girders, and at tops of foundations or floor slabs, unless shown otherwise. At Contractor's option, beam pockets may be formed into concrete walls. Size pockets to allow beam reinforcing to be placed as detailed on Drawings. Place beams, girders, column capitals and drop panels at same time as slabs. Make joints perpendicular to main reinforcement with all reinforcement continuous across joints. Provide roughened construction joints at all construction joints unless indicated otherwise on Drawings. Clean the previously hardened concrete interface and remove all laitance. Intentionally roughen the interface to a full amplitude of 1/4 inch. Provide recessed flat surface as required to install strip type waterstops. Allow a minimum of 48 HRS before placement of adjoining concrete construction.

3.1.2 Contraction Joints

Contraction joints may be constructed by cutting the concrete with a saw after concrete has set. Joints shall be approximately 1/8 inch wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 1 inch.

3.1.2.1 Sawed Joints

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

sequence of concrete placement.

3.1.2.2 Waste Disposal

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

3.1.3 Expansion Joints

Do not permit reinforcement or other embedded metal items bonded to concrete (except smooth dowels bonded on only one side of joint) to extend continuously through an expansion joint. Use approved expansion joint fillers, unless noted otherwise on Drawings.

3.1.4 Joint Sealant

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

3.2 WATERSTOPS, INSTALLATION AND SPLICES

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

3.2.1 Non-Metallic Hydrophilic

Install on smooth surface of hardened concrete by use of nails, adhesive or other means as recommended by manufacturer to prevent movement of waterstop during placement of concrete. Waterstop to be continuous with splices in accordance with manufacturer's instructions. Use in joints against existing concrete and where indicated on Drawings.

3.2.2 PVC Bulb type

Position waterstop accurately in forms. Secure waterstops in correct position using hog rings or grommets spaced along the length of waterstop and tie wire to adjacent reinforcing. Hold horizontal waterstops in place with continuous supports. Install according to manufacturer's instructions. Do not displace reinforcement from required location. Waterstops to be continuous. Splice ends with perpendicular butt splice using electrical splicing iron in accordance with manufacturer's instructions. Unless otherwise noted, use for all construction joints in

new construction for all structures indicated on Drawings.

3.2.3 Quality Assurance

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

3.2.4 Non-Metallic Hydrophilic Waterstop Installation

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

3.3 CONSTRUCTION JOINTS

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

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SECTION 03200

CONCRETE REINFORCEMENT

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SECTION 03200

CONCRETE REINFORCEMENT
04/01

PART 1 GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)

- | | |
|--------------|--|
| ACI 318/318R | (1995) Building Code Requirements for Structural Concrete and Commentary |
| ACI SP-66 | ACI Detailing Manual |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- | | |
|------------|--|
| ASTM A 53 | (1999) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless |
| ASTM A 82 | (1997a) Steel Wire, Plain, for Concrete Reinforcement |
| ASTM A 615 | (1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement |
| ASTM A 706 | (1998) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement |

AMERICAN WELDING SOCIETY (AWS)

- | | |
|----------|--|
| AWS D1.4 | (1998) Structural Welding Code - Reinforcing Steel |
|----------|--|

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

- | | |
|------------|------------------------------------|
| CRSI MSP-1 | (1996) Manual of Standard Practice |
|------------|------------------------------------|

1.2 QUALITY ASSURANCE

1.2.1 Quality Control

Independent Testing Agency: Contractor to employ and pay for services of a testing laboratory to: Review and approve Contractor proposed welding procedures and processes for conformance with AWS D1.4. Qualify welders in accord with AWS D1.4. Test three samples of each bar size and each type of

weld in accord with AWS D1.4. The tensile strength of each test shall be not less than 125 percent of the required yield strength of the rebar tested. Conduct nondestructive field tests (radiographic or magnetic particle) on not less than one random sample for each 10 welds. In addition if any welds are found defective, test five previous welds performed by same welder. Visually inspect each weld for presence of cracks, undercuts, inadequate size and other visible defects.

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

Concrete Reinforcement System; GA.

Detail drawings showing rebar number, sizes, spacing, dimensions, configurations, locations, mark numbers, lap splice lengths and locations, concrete cover and rebar supports. Sufficient rebar details to permit installation of reinforcing. Rebar details in accordance with ACI SP-66. Locations where proprietary rebar mechanical splices are required or proposed for use.

SD-06 Instructions

Adhesive Anchors; GA

Proprietary Rebar Mechanical Splices; GA

Manufacturer's installation instructions. Manufacturer and type of proprietary rebar mechanical splices. Manufacturer and type of rebar adhesive anchor including installation instructions and embedment depth required to achieve specified pull-out strength.

SD-08 Statements

Welding; FIO.

A list of qualified welders names.

SD-13 Certificates

Product Technical Data; FIO.

Acknowledgement that products submitted meet requirements of standards referenced. Mill certificates for all reinforcing attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

1.4 WELDING

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4. Welders to have been qualified during the previous 12 months prior to commencement of welding.

1.5 DELIVERY AND STORAGE

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

PART 2 PRODUCTS

2.1 DOWELS

Dowels shall conform to ASTM A 615, Grade 60, with metal end cap to allow longitudinal movement equal to joint width plus 1 inch. Steel pipe conforming to ASTM A 53, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

2.2 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615 or ASTM A 706, grades and sizes as indicated. Cold drawn wire used for spiral reinforcement shall conform to ASTM A 82.

2.3 WIRE TIES

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

2.4 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 4 inches square when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 1/2 inch of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks or plastic coated steel fabricated with bearing plates.

2.5 PROPRIETARY REBAR MECHANICAL SPLICES

To develop in tension and compression a minimum of 125 percent of the yield strength of the rebars being spliced.

2.6 WELDING ELECTRODES

E90 meeting requirements of AWS D1.4.

2.7 REBAR ADHESIVE ANCHORS

Manufactured for the specific purpose of embedding and developing 125 percent of the yield strength of rebars in hardened concrete.

2.8 FABRICATION

2.8.1 Tolerances.

Tolerances: Sheared lengths: +/- 1 inch. Overall dimensions of stirrups, ties and spirals: +/- 1/2 inch. All other bends: +0 inch, -1/2 inch.

Minimum diameter of bends measured on the inside of the rebar to be as indicated in ACI 318/318R paragraph 7.2. Ship rebars to jobsite with attached plastic or metal tags. Place on each tag the mark number of the rebar corresponding to the mark number indicated on the shop drawing. Mark numbers on tags to be so placed that the numbers cannot be removed.

PART 3 EXECUTION

3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318/318R. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete.

Reinforcement shall be placed in accordance with ACI 318/318R at locations shown plus or minus one bar diameter (measured parallel with face of form).

Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage (measured perpendicular to face of form) shall be as indicated on drawings.

3.1.2 Splicing

Splices of reinforcement shall conform to Paragraph 12.15 of ACI 318/318R and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Obtain approval by the Engineer prior to welding reinforcement. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Do not tack weld reinforcing. Have each welder place an

approved identifying mark near each completed weld. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. Mechanical proprietary splice connectors may only be used when approved, or indicated on the Contract Drawings. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line. Where parallel horizontal reinforcement in beams is indicated to be placed in two or more layers, rebars in the upper layers shall be placed directly above rebars in the bottom layer with clear distance between layers to be 6 inches. Place spacer rebars at 3 feet maximum centers to maintain the required clear distance between layers. Extend reinforcement to within 4 inches of concrete perimeter edges unless noted otherwise on contract drawings.

3.1.3 Rebar Support

Support rebars and fasten together to prevent displacement by construction loads or placing of concrete. On ground, provide supporting concrete blocks or metal bar supports with bottom plate. Over formwork, provide chairs, runners, bolsters, spacers, hangers and other rebar support.

3.1.4 Adhesive Anchors

Embed rebars into hardened concrete utilizing adhesive anchor system specifically manufactured for such installation. Drill hole in concrete with diameter and depth as required to develop 125 percent of the yield strength of the bar according to manufacturer's requirements. Place adhesive in drilled hole. Insert rebar into hole and adhesive in accordance with manufacturer's instructions.

3.1.5 Tolerances

Rebar placement: Clear distance to formed surfaces: +1/4 inch. Minimum spacing between bars: -1/4 inch. Top bars in slabs and beams: Members 8 IN deep or less: +1/4 inch. Members between 8 inch and 2 feet deep: -1/4 inch, +1/2 inch. Members more than 2 FT deep: -1/4 inch, +1 inch. Crosswise of members: Spaced evenly within +/- 1 inch. Lengthwise of members: +/- 2 inch. Minimum clear distances between rebars: Beams, walls and slabs: Distance equal to rebar diameter or 1 inch, whichever is greater. Columns: Distance equal to 1-1/2 times the rebar diameter or 1-1/2 inch, whichever is greater. Beam and slab rebars shall be threaded through the column vertical rebars without displacing the column vertical rebars and still maintaining the clear distances required for the beam and slab rebars.

3.2 DOWEL INSTALLATION

Dowels shall be installed at locations indicated and at right angles to

joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

3.3 FIELD QUALITY CONTROL

3.3.1 Reinforcement Congestion and Interferences

Notify Engineer whenever the specified clearances between rebars cannot be met. Do not place any concrete until the Engineer submits a solution to rebar congestion problem. Rebars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If rebars are moved more than one bar diameter, obtain Engineer's approval of resulting arrangement of rebars. No cutting of rebars shall be done without written approval of Engineer.

-- End of Section --

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04/01

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SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE
04/01

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 201.2R | (1992) Guide to Durable Concrete |
| ACI 211.1 | (1991) Standard Practice for Selecting Proportions for Normal, heavyweight and Mass Concrete |
| ACI 212.3 | (1998) Chemical Admixtures for Concrete |
| ACI 301 | (1996) Standard Specifications for Structural Concrete |
| ACI 303 | (1991) Guide to Cast-In-Place Architectural Concrete Practice |
| ACI 304 | (1989) Measuring, Mixing, Transporting and Placing Concrete |
| ACI 304.2 | (1991) Placing Concrete by Pumping Methods |
| ACI 305 | (1991) Hot Weather Concreting |
| ACI 306 | (1988) Cold Weather Concreting |
| ACI 309 | (1997) Guide for Consolidation of Concrete |
| ACI 318/318R | (1999) Building Code Requirements for Structural Concrete and Commentary |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-----------|---|
| ASTM C 31 | (1998) Making and Curing Concrete Test Specimens in the Field |
| ASTM C 33 | (1999a) Concrete Aggregates |

| | |
|-------------|---|
| ASTM C 39 | (1996) Compressive Strength of Cylindrical Concrete Specimens |
| ASTM C 94 | (1999) Ready-Mixed Concrete |
| ASTM C 136 | (1996a) Sieve Analysis of Fine and Coarse Aggregates |
| ASTM C 138 | (1981) Unit Weight, Yield, and Air Content (Gravimetric) of Concrete |
| ASTM C 143 | (1998) Slump of Hydraulic Cement Concrete |
| ASTM C 150 | (1998a) Portland Cement |
| ASTM C 171 | (1997a) Sheet Materials for Curing Concrete |
| ASTM C 172 | (1999) Sampling Freshly Mixed Concrete |
| ASTM C 173 | (1994ael) Air Content of Freshly Mixed Concrete by the Volumetric Method |
| ASTM C 231 | (1997el) Air Content of Freshly Mixed Concrete by the Pressure Method |
| ASTM C 260 | (1998) Air-Entraining Admixtures for Concrete |
| ASTM C 289 | Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method) |
| ASTM C 309 | (1998a) Liquid Membrane-Forming Compounds for Curing Concrete |
| ASTM C 494 | (1999) Chemical Admixtures for Concrete |
| ASTM C 618 | (1999) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete |
| ASTM C 685 | (1998a) Concrete Made by Volumetric Batching and Continuous Mixing |
| ASTM C 881 | (1999) Epoxy-Resin-Base Bonding Systems for Concrete |
| ASTM C1059 | (1999) Latex Agents for Bonding Fresh to Hardened Concrete |
| ASTM C 1064 | (1999) Temperature of Freshly Mixed Portland Cement Concrete |

| | |
|-------------|---|
| ASTM C 1077 | (1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation |
| ASTM C 1107 | (1999) Packaged Dry, Hydraulic-Cement Grout (Non shrink) |
| ASTM D 75 | (1997) Practice for Sampling Aggregates |
| ASTM E 329 | (1990) Standard Practice for Use in the Evaluation of Testing and Inspection Agencies as Used in Construction |

CORPS OF ENGINEERS (COE)

| | |
|---------------|---|
| COE CRD-C 621 | (1989) Specification for Non-shrink Grout |
|---------------|---|

NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

| | |
|----------------|---|
| NRMCA TMMB-100 | (1994) Truck Mixer Agitator and Front Discharge Concrete Carrier Standards of the Truck Mixer Manufacturers Bureau |
| NRMCA QC 3 | (1984) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities |

1.2 QUALITY ASSURANCE

1.2.1 Quality Control.

Independent Testing Agency: Contractor to employ and pay for services of a testing laboratory to: Perform materials evaluation and inspection and to design concrete mixes. Concrete testing agency to meet requirements of ASTM E 329 and ASTM C 1077. Do not begin concrete production until proposed concrete mix design has been approved by Engineer. Approval of concrete mix design by Engineer does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant. Do not use revised concrete mixes until submitted to and approved by Engineer. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon.

1.2.2 Qualifications

Ready mixed concrete batch plant certified by National Ready Mixed Concrete Association (NRMCA).

1.3 SUBMITTALS

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

SD-08 Statements

Concrete Mixture Design; 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.

A mix design shall be submitted for each concrete mix to be used on the project. Concrete mix design submittal is to include the following information:

- a. Sieve analysis and source of fine and coarse aggregates.
- b. Test for aggregate organic impurities.
- c. Test for deleterious aggregate per ASTM C 289.
- d. Proportioning of all materials.
- e. Type of cement with mill certificate for cement.
- f. Type of fly ash with certificate of conformance to specification requirements.
- g. Slump.
- h. Air content.
- i. Brand, type, ASTM designation, and quantity of each admixture proposed for use.
- j. 28-day cylinder compressive test results of trial mixes per ACI 318/318R and as indicated herein.
- k. Shrinkage test results.
- l. Standard deviation value for concrete production facility. Project Data. Submit evidence obtained within the last 5 years from previous quality control testing on the concrete mix.
- m. Results of fine aggregate tests for gradation and durability.
- n. Results of coarse aggregate tests for gradation and durability.

All materials included in the mixture shall be of the same type and from the same source as will be used on the project. Each mix shall be accompanied by evidence by one of the following methods that demonstrates the mix will produce concrete having the characteristics and quality as specified:

- a. Project Data. Submit evidence obtained within the last 5 years

from previous quality control testing on the concrete mix.

- b. Mix Design Study. Submit a mix design study complying with ACI 211.1 conducted in the past 12 months. The mix design shall be completed by a testing laboratory complying with ASTM C 1077.

Project data or mix design studies shall be obtained for the exact mix as submitted. Minor mix alterations or substitutions may be accepted if approved by the Contracting Officer. Any alternations or substitutions shall be clearly identified, and shall be accompanied by recommendations from the admixture supplier or a registered professional engineer indicating the expected effects on the concrete.

Concrete Operation Plan; GA.

The plan shall demonstrate a thorough understanding of all involved technical and logistical conditions necessary for the production of concrete that meets all requirements of these specifications. The plan shall provide as a minimum the following:

- a. Sources of cement, pozzolan, and aggregates.
- b. Location of aggregate stockpiles, batching plant, and mixing plant.
- c. Method and route for conveying batched concrete under all expected weather conditions.
- d. Method of conveying concrete within the project.
- e. Sources of electrical power and water.
- f. Provisions for replacement of required equipment in the event of breakdown.
- g. Methods for preventing aggregate stockpiles from freezing, moisture variation, or contamination.
- h. Methods of consolidation and curing. Include manufacturer's literature.
- i. Contractor quality control.

Cold Weather Plan; GA.

If concrete is to be placed under cold weather conditions, the procedures, materials, methods, and protection proposed to accomplish it shall be submitted for review.

Hot Weather Plan; GA.

If concrete is to be placed under hot weather conditions, the procedures, materials, methods, and protection proposed to accomplish it shall be submitted for review.

Joint Treatment Plan; GA..

The methods and equipment proposed for joint cleanup and waste disposal shall be submitted for review.

SD-09 Reports

Concrete Testing Reports; FIO.

Per Article 3.13.

SD-13 Certificates

Manufacturer's Certificates; GA.

The following materials shall be certified for compliance with all specification requirements. Submit manufacturer, type and product literature:

- a. Cement and pozzolan
- b. Impervious sheet curing materials
- c. Admixtures
- d. Curing compound
- e. Bonding and patching mortar
- f. Bonding agent and epoxy adhesive
- g. Non-shrink grout and cure/seal compound
- f. Special surface finish materials

Qualifications; FIO.

Written documentation for Contractor Quality Control personnel and Independent Testing Agency.

Batch Tickets; FIO

Batch tickets shall be collected and furnished to the Contracting Officer for each load of ready-mixed concrete. The batch tickets do not need to be transmitted through the submittal process. Ticket to show:

- 1) Mix identification mark.
- 2) General name of structure to which concrete is to be placed.
- 3) Quantity delivered.
- 4) Amount of each material in batch.
- 5) Outdoor temperature in the shade.
- 6) Time at which cement was added.
- 7) Time of delivery.
- 8) Time of discharge.
- 9) Numerical sequence of the delivery.
- 10) Amount of water added.

1.4 QUALIFICATIONS

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

1.5 CONSTRUCTION TOLERANCES

Variation in alignment, grade, and dimensions of the structures from the established alignment, grade, and dimensions shown shall be within the tolerances specified in SECTION 03100 - CONCRETE FORMWORK.

1.5.1 Appearance

Finished surfaces shall be protected from stains or abrasions. Permanently exposed surfaces shall be cleaned, if stained or otherwise discolored, by an approved method that does not harm the concrete. Abrupt variations in color, shade, or tint will not be permitted on these surfaces.

1.6 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. Do not use cementitious materials if caked or lumpy. 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. Do not use frozen or partially frozen aggregates. Allow sand to drain until moisture content is uniform prior to use. Reinforcing bars and accessories shall not be stored on cohesive soils or areas that may puddle water. 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.

1.7 GOVERNMENT ASSURANCE INSPECTION AND TESTING

The Contracting Officer may appoint a Government representative or an independent testing laboratory to inspect construction and monitor operations of the Contractor's CQC staff as considered appropriate for quality assurance. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Government inspection or testing will not relieve the Contractor of any of its CQC responsibilities. 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 GENERAL CONCRETE REQUIREMENTS

Concrete shall be ready mixed concrete conforming to ASTM C 94. All concrete to be normal weight concrete. Water-cement ratio shall not exceed 0.44. Materials shall meet the requirements of the respective publications and other data specified below.

2.1.1 Strength Requirements

The design compressive strength ($f'c$) shall not be less than 4,000 pounds per square inch. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength $f'c$ and no

individual test result falls below the specified strength f'c by more than 500 psi. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Design compressive strength (f'c) shall be evaluated for acceptance at 28 days unless pozzolan is used, in which case the design strength shall be met in 90 calendar days, provided the 90-day period does not extend past the contract expiration date. Members identified with concrete not meeting the criteria shall be replaced. The Contractor may conduct additional testing to verify strength or further define the limits of inferior concrete if approved by the Contracting Officer.

2.1.2 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall not exceed 3 inches and, shall not be less than 1 inch. Slump is measured at point of discharge of the concrete into the concrete construction member. If a superplastizer is used, the slump shall not exceed 3 inches before the admixture is added and shall not exceed 8 inches at the point of delivery after the admixture is added. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated. Pumped concrete: Provide additional water at batch plant to allow for slump loss due to pumping. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified above. Determine slump per ASTM C 143.

2.1.3 Admixtures

Concrete shall not contain admixtures that provide special properties to the concrete unless specified or approved. Admixtures to be used on the project shall be included in the mix design submittals. Accelerating admixtures shall be used only during cold weather and when approved in writing.

2.1.3.1 Air Entrainment

Air entrained concrete will be required in all structures except for the footings of the closure structures.

Reference ACI 201.2R, Table 1.4.3, recommended air content for severe exposure:

| | | | | |
|------------------------|------|----|------|------|
| Nominal max. aggregate | 3/4" | 1" | 1.5" | 3" |
| Ave. air content | 6% | 6% | 5.5% | 4.5% |

A reasonable tolerance is + or - 1.5% subject to the limits in the following paragraph:

All concrete shall be air entrained to contain between 5 and 7 percent total air. Air content to be measured in accordance with ASTM C 231, ASTM C 173, or ASTM C 138.

2.1.4 Gradation of Aggregates

Nominal maximum size coarse aggregate shall be 1-1/2 inches, except 3/4 inch nominal maximum size coarse aggregate shall be used when any of the following conditions exist: the narrowest dimension between sides of forms is less than 7-1/2 inches, the depth of the slab is less than 4-1/2 inches, or the minimum cover or clear spacing between reinforcing is less than 2 inches.

2.2 CEMENTITIOUS MATERIALS

Cementitious materials shall be portland cement, or portland cement in combination with pozzolan. Minimum cement content shall be 611 pounds per cubic yard. Optional pozzolan replacement of cement shall be limited to 20 percent of the total cementitious material of a mix by weight for 15% of the cement content. Cementitious materials 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.

2.2.1 Portland Cement

ASTM C 150, Type I with a maximum 15 percent amount of tricalcium aluminate, or Type II.

2.2.2 Pozzolan (Fly Ash)

ASTM C 618, Class C or F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. Requirement for maximum alkalis from Table 1A of ASTM C 618 shall apply. Nonstaining. Hardened concrete containing fly ash to be uniform light gray color. Maximum loss on ignition: 4 percent. Compatible with other concrete ingredients.

2.3 AGGREGATES

2.3.1 Composition

Fine aggregate shall consist of clean natural sand. Coarse aggregate shall consist of natural gravel, crushed rock, or other inert granular material. Maximum amount of clay or shale particles: 1 percent.

2.3.2 Quality

The aggregate particles shall be clean, hard, unweathered, and uncoated. The shape of the particles shall be generally cubical or spherical. Where required, fines shall be removed from the aggregates by adequate washing. The aggregates as delivered to the mixer shall meet the quality requirements of ASTM C 33, Table 3 for the appropriate type or location of concrete construction for use in a severe climate.

2.3.3 Sources

Unless approved otherwise, aggregates shall be produced from the sources listed in SECTION 00830 - ATTACHMENTS. If the Contractor proposes to

furnish aggregates from a source not listed, the Government will make such tests and other investigations as necessary to determine whether or not aggregates meeting the requirements of this project can be produced from the proposed source. The tests to which the aggregate will be subjected may include specific gravity, absorption, Los Angeles abrasion, soundness in magnesium sulfate, petrographic analysis, freezing and thawing in concrete, alkali-aggregate reaction, organic impurities, deleterious materials, and other tests necessary to determine that concrete of acceptable quality and cost can be produced from the materials proposed. These tests will be conducted in accordance with the applicable Corps of Engineers methods of testing given in the Handbook for Concrete and Cement.

When the Contractor desires to use aggregates from a source not listed, suitable samples for quality evaluation consisting of not less than 700 pounds of each size of coarse aggregate and 300 pounds of fine aggregates shall be taken in accordance with ASTM D 75 and delivered to the Contracting Officer or to a laboratory as directed. Sampling and shipping of samples shall be at the Contractor's expense. A maximum of 120 calendar days will be required to complete evaluation of the aggregate.

2.4 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed.

- a. Air-Entraining Admixture. ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.
- b. Accelerating Admixture. ASTM C 494, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.
- c. Water-Reducing or Retarding Admixture. ASTM C 494, Type A and B.
- d. High-Range Water Reducer. ASTM C 494, Type F or G.
- e. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer and at no cost to Owner.

2.5 CURING MATERIALS

2.5.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except that polyethylene sheet shall be white opaque.

2.5.2 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. Membrane-forming curing compound shall not be used on surfaces that are to be treated with floor hardener.

2.6 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of oil, acid, salt, or alkali. Water for curing shall not contain any substance that stains the concrete. River water shall not be used.

2.7 GROUT

2.7.1 Nonshrink Grout:

Nonmetallic, noncorrosive, nonstaining, premixed with only water to be added. Grout to produce a positive but controlled expansion. Mass expansion not to be created by gas liberation. Minimum compressive strength of nonshrink grout at 28 days: 6500 psi.

2.7.2 Epoxy Grout:

3-component epoxy resin system: Two liquid epoxy components and one inert aggregate filler component. Each component packaged separately for mixing at jobsite.

2.8 BONDING AGENT

ASTM C1059, Type II.

2.9 BONDING GROUT

One part cement to one part aggregate. Mix cement and aggregate. Mix bonding agent and water together in separate container in accordance with manufacturer's instructions. Add bonding agent/water mixture to cement/aggregate mixture. Mix to consistency of thick cream. Bonding agent itself may be used as bonding grout if approved by manufacturer and Engineer.

2.10 PATCHING MORTAR

One part cement to two and one-half parts aggregate by damp loose volume. Substitute white Portland cement for a part of gray Portland cement to produce color matching surrounding concrete. Mix cement and aggregate. Mix bonding agent and water together in separate container in accordance with manufacturer's instructions. Add only enough bonding agent/water mixture to cement/aggregate mixture to allow handling and placing. Let stand with frequent manipulation with a trowel, until mix has reached stiffest consistency to allow placement.

2.11 EPOXY ADHESIVE

ASTM C 881, Type V.

2.12 EMBEDDED ITEMS

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

PART 3 EXECUTION

3.1 CONCRETE FINISH SCHEDULE

- a. Broomed Finish. A broomed finish shall be applied to the following surfaces: walks, exterior stairs, surfaces to receive terrazzo, treads of concrete pan stairs, and exterior slab closure. Exterior surfaces shall be sloped for drainage, unless otherwise shown.
- b. Float Finish. Surfaces to be float-finished shall include the top of the structural slab where insulation is to be applied and all remaining surfaces not specified elsewhere. The finished surface shall be a true plane within 5/16 inch in 10 feet.
- c. Trowel Finish. A steel trowel finish shall be applied to all floor surfaces, unless otherwise specified or indicated.
- d. Forms. Surfaces, unless another type of finish is specified, shall be left with the texture imparted by the forms, except defective surfaces shall be repaired as described below. Forms shall not be reused if there is any evidence of surface wear or defects that would impair the quality of the surface.
- e. Horizontal Concrete Repairs. Concrete shall be screeded, floated, and lightly troweled to a finish approved by the Contracting Officer. The finished surface shall be a true plane within 5/16 inch in 10 feet.

3.2 PREPARATION FOR PLACING

Surfaces to receive concrete shall be clean, damp and free from frost, ice, mud, loose particles, foreign matter, and water. Forms shall be in place, cleaned, coated, and adequately supported. Reinforcing steel shall be in place, cleaned, tied, and adequately supported. 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. Concrete shall not be placed before the completion of all adjacent pile driving or other operations that might prove detrimental to freshly placed concrete.

3.2.1 Soil Subgrades

Immediately prior to setting forms and reinforcement, the foundation shall be compacted with a manual tamper.

3.2.2 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.

3.3 CONCRETE PRODUCTION

Concrete shall be furnished from a ready-mixed concrete plant, except that small batches for pours less than 2 cubic yards may be batched on-site. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94. Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB-100. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Aluminum pipes, chutes, troughs, spouts, or tremies shall not be used for pumping, conveying, or placing concrete.

3.3.1 Concrete Mixers

The mixers shall not be charged in excess of the capacity recommended by the manufacturer. Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C 94. 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.

3.3.2 Site Mixed Concrete

If the Contractor elects to provide an on site batching and mixing plant, a batch type plant shall be provided of sufficient capacity to prevent cold joints. Site-mixed concrete shall be produced in conformance with ACI 301, or by volumetric batching and continuous mixing in conformance with ASTM C 685.

3.4 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in truck mixers.

3.5 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer to forms by methods that will prevent segregation or loss of ingredients. Any concrete transferred from one conveying device to another shall be passed through a hopper, which is conical in shape, and shall not be dropped vertically more than 5 feet, except where suitable equipment is provided to prevent segregation and where specifically authorized. Trucks shall be equipped with radios or phones to permit communication between the mixing plant and the concrete placement site.

3.5.1 Concrete Pumps

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 5 inches. The maximum size coarse aggregate will not be reduced to accommodate the pumps. The distance to be pumped shall not exceed limits recommended by the pump manufacturer. The concrete shall be supplied to the concrete pump continuously. When pumping is completed, concrete remaining in the pipeline shall be ejected without contamination of concrete in place. After each operation, equipment shall be thoroughly cleaned, and flushing water shall be wasted outside of the forms and in compliance with the approved environment protection plan.

3.6 PLACING CONCRETE

Place concrete in compliance with ACI 304 and ACI 304.2. Mixed concrete shall be discharged within 1-1/2 hour 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 length of haul makes it impossible to deliver truck-mixed concrete within this time limit, batching of cement and a portion of the mixing water shall be delayed until the truck mixer is at or near the construction site. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints. Do not allow concrete to freefall more than 4 feet.

3.6.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 18 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 so that fresh concrete is deposited on in-place concrete that is still plastic.

3.6.2 Consolidation

Consolidation of concrete shall conform to ACI 309, except as otherwise specified. Immediately after placing, each layer of concrete shall be consolidated by internal vibrators. 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. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 6 inches into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not

be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Excessive vibration of concrete resulting in segregation shall be prevented.

3.6.3 Cold Weather Requirements

Concrete shall not be placed without a procedure approved in accordance with paragraph: SUBMITTALS when the concrete is likely to be subjected to freezing temperatures before the expiration of the curing period. Heating of the mixing water or aggregates will be required to regulate the concrete-placing temperatures. The placing temperature of the concrete shall be as recommended in ACI 306, Table 3.1, with the temperature of the concrete measured in accordance with ASTM C 1064. Do not place heated concrete that is warmer than 80 degrees F. Air and form temperature in contact with concrete shall be above 50 degrees F prior to placing concrete and maintained for the first 3 days, and at a temperature above 32 degrees F for the remainder of the specified curing period. Do not place concrete on frozen ground. Thermometers shall be installed at such locations as may be directed. Suitable thermometers shall be furnished by the Contractor and installed adjacent to the concrete surface and 2 inches inside the surface of the concrete. During the period of protection removal, heat shall be shut down and insulation or tents shall be removed in a systematic schedule such that the temperature differential between the air and concrete surface does not exceed 25 degrees F. 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 entering the mixer shall be free from ice, snow, or frozen lumps.

3.6.4 Hot Weather Requirements

Concrete shall be properly placed and finished with approved procedures in accordance with paragraph: SUBMITTALS. 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. The concrete-placing temperature shall not exceed 85 degrees F (60 degrees F for concrete for horizontal repairs). 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. Steel forms and reinforcements shall be cooled prior to concrete placement when steel temperatures are greater than 120 degrees F. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature. When the rate of evaporation of surface moisture, as determined by use of Figure 2.1.5 of ACI 305, may reasonably be expected to exceed 0.2 pounds per square feet per hour, provision for windbreaks, shading, fog spraying, or wet covering with a light-colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as finishing operations will allow.

3.7 JOINTS

All joints not shown on the drawings are subject to approval by the

Contracting Officer. Joints shall be perpendicular to the main reinforcement. Place waterstops per SECTION 03150: EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

3.7.1 Construction Joints

Concrete shall be placed continuously so that structural members are monolithic in construction. Construction joints shall be located and constructed 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. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 48 hours old.

3.7.1.1 Preparation for Construction Joints

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. Surfaces shall be thoroughly washed and shall be damp but without free water when concrete is placed or joint shall be coated with epoxy adhesive or cement grout. The concrete surface shall be free of all accumulated laitance, coatings, stains, debris, loose material, and other foreign matter. Laitance shall be removed when the concrete is sufficiently hard so that only the surface skin or mortar is removed and there is no undercutting of coarse aggregate particles. The surface shall be cleaned as the last operation prior to closing forms and obstructing the area with reinforcement.

3.7.2 Expansion and Contraction (Control) Joints

See SECTION 03150: EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS

3.8 REPAIR OF SURFACE DEFECTS

3.8.1 Preparation for Surface Repairs

Preparation for surface repairs shall follow the requirements for preparation for construction joints, with the following additional criteria: The surface preparation shall include air-water cutting, sandblasting, high-pressure water jet, or other approved method. The surface shall be cleaned as the last operation prior to placing concrete or obstructing the area with reinforcement. The surface shall be watered for 12 hours prior to placing concrete. Horizontal surfaces shall be air blasted to remove puddled water.

3.8.2 Repairing Surface Defects

Repair shall follow procedure of "Finishing Formed Surfaces" below.

3.9 FINISHING FORMED SURFACES

Beginning no more than 24 hours after form removal,, all fins and loose materials shall be removed. All voids and honeycombs exceeding 1/2 inch in diameter and all tie rod holes shall be reamed or chipped and filled with

patching mortar. Voids and honeycomb shall be dampened, brush-coated with a neat cement grout or with an approved bonding agent, and filled with patching mortar. Allow bonding grout to set for period of time required by bonding agent manufacturer before applying premixed patching mortar. Mortar shall be thoroughly compacted in place and struck off to adjacent concrete, or mortar during remedial work, including curing, shall be above 50 F. The patched areas shall be cured for seven days. Defective areas larger than 36 square inches in any surface shall be replaced or corrected as directed by the Contracting Officer.

3.9.1 Ordinary and Sack Rubbed Surface Finishes

An Ordinary Surface Finish or Sack Rubbed Surface Finish shall be applied to new exposed concrete surfaces of the Pump Station K-12 tie-in walls and discharge levee chamber/gate well and the closure structure surfaces not covered with brick or shale veneer. It shall also include the existing concrete surface of the flood wall adjacent to K-12 that is exposed due to re-grading or damaged by construction. The term "exposed surfaces", as used hereinafter, shall mean exposed to public view in the completed structure above a point 6 inches below the final groundline. The Contractor, at the Contractor's option, may use the Sack Rubbed Method to fill smaller voids in lieu of the Ordinary Method. In addition to the Ordinary or Sack Rubbed Surface Finish, a Special Surface Finish will be applied to the new concrete and also a Special Surface Finish will be applied to existing concrete. All exposed new concrete surfaces shall receive an ordinary or sack rubbed surface finish.

3.9.1.1 Ordinary Surface Finish

As soon as possible after removal of the forms, the concrete surfaces shall be examined for areas of unsound concrete and defective surfaces due to improper concrete placement, faulty form work, faulty form removal, and other causes. Concrete with porosity, honey comb, or segregated materials shall be removed and replaced, but the ordinary surface finish shall not be started until the Engineer has viewed the extent of the defective concrete and has approved the time and method of repair and the materials to be used. In general, small areas may be repaired with mortar as specified for surface cavities; large areas may require concrete with formed surfaces.

A bonding agent, mechanical bonds, or both may be required, and all repair work shall be cured in an approved manner. When defects in a concrete section are so extensive that satisfactory repairs cannot be made, that section will be considered unacceptable work. All fins and irregular projections shall be removed from exposed surfaces and form surfaces that will be waterproofed. All surface cavities produced by form ties, and on exposed surfaces, any surface cavities (bug holes) with a diameter of approximately 3/8 inch and larger, and smaller surface cavities so closely spaced as to be conspicuous shall be thoroughly cleaned, saturated with water, and filled with mortar. The mortar shall consist of 1 part white cement, 2 parts standard Portland cement, 6 parts mortar sand, and water. For surfaces which will not be exposed to view, standard Portland cement may be substituted for the white cement. The amount of water used shall produce a mortar consistency as dry as possible to use effectively, and to further reduce plastic shrinkage, the mortar shall be mixed about one hour

in advance of use. An approved latex or acrylic-based bonding agent shall be incorporated into the mortar used for performing the ordinary surface finish. with mortar, thoroughly compacted into place, pointed, and trimmed flush with the concrete surface.

On exposed surfaces, mortar stains or streaks outside the area of the filled cavity shall be avoided and, if they should occur, they shall be removed. When the specifications or drawings do not specify additional surface finishing on an exposed surface, at the time of completion of all concrete work on the structure, all conspicuous streaks, stains, and blemishes shall be removed from the surface. Additional surface finishing shall also be done on an exposed surface that requires only ordinary surface finish, when the ordinary surface finish is performed before the completion of the curing period for the concrete being finished, the finishing shall be done with a minimum of interruption to the curing.

3.9.1.2 Sack Rubbed Surface Finish

Where numerous surface voids are present on an exposed surface, the Sack Rubbed Finish may be used to fill the smaller voids in lieu of the method described under Ordinary Surface Finish. However, the filling of form tie holes and other large cavities shall be done as specified under Ordinary Surface Finish. As a preparatory operation, the entire surface shall be ground with a high-speed, electric, disk-type grinder or sandblasted until blemishes, discoloration, and thin mortar films covering surface voids have been removed. When the structure has been completed to the extent that further blemishes and discolorations on the surface will not result from any remaining construction, the final operations shall be performed as follows:

1) Initial Operation

The surface shall be thoroughly saturated with water and while the surface is still moist, a mortar mixture (consisting of 1 part white cement, 1 part standard Portland cement, and 2 parts mortar sand, with sufficient water added to produce a moderately thick paste) shall be applied to the wetted area with a rubber float, starting at the top. All voids shall be completely filled during this operation. If any portion of the surface shows evidence of becoming dry before the mortar is applied, it shall be rewetted.

2) Operations During Mortar Cure

After the mortar has set sufficiently to be retained within the voids, and before it has become completely dry, the entire surface which has been floated with mortar shall be rubbed with a small burlap sack filled with a dry mix (sand and cement only) of the mortar described above. All mortar in excess of that required to fill the voids shall be removed during the dry mortar sack rubbing operations. In lieu of the dry mix filled burlap sack, any equally effective means of removing the excess mortar will be approved.

3) Final Operation

The completed surface shall be free of blemishes, discolorations, surface

voids, and conspicuous form marks. The surface shall be uniform in texture and appearance except for the difference in texture between filled voids and the remainder of the surface. Surfaces that do not meet these requirements shall be corrected to the satisfaction of the Engineer.

3.9.2 Special Surface Finish

A special surface finish will be required on all new exposed surfaces of the Pump Station K-12 tie-in walls and discharge levee chamber/gate well and the closure structure surfaces not covered with brick or shale veneer. It shall also include the existing concrete surface of the flood wall adjacent to K-12 that is exposed due to re-grading or damaged by construction. The term "exposed surfaces", as used hereinafter, shall mean exposed to public view in the completed structure above a point 6 inches below the final groundline.

The objective of this operation is to obtain a surface that is reasonably smooth and uniform in texture and appearance. The Special Surface Finish requirements shall not relieve the Contractor of full responsibility for performing the Ordinary Surface Finish as specified. The Special Surface Finishing shall be performed using an approved mixture of commercial packaged mortar acrylic-based bonding agent, with acrylic-based paint in a gray color, similar to that of the floodwall adjacent to Pump Station K-12, as approved by the Government. The materials used for the mixture shall be compatible with each other.

Manufacturers' data sheets showing applicability to the project use and with storage, mixing, and application instructions shall be submitted for approval. The same material and methods shall be used for all surfaces specified to be given a Special Surface Finish. Formed surfaces and existing surfaces shall receive a sweep sandblast to break the surface film and to remove all laitance, form release agent, and other foreign matter that may impede adhesion of the Special Surface Finish. All surfaces that are to receive a Special Surface Finish shall be thoroughly flushed down with clean water not more than 24 hours before commencing the Special Surface Finish. The approved materials shall be thoroughly mixed with water in accordance with an approved formulation and to the degree necessary for application in accordance with the manufacturer's instructions. The mixture shall be applied by brushing or spraying in sufficient thickness to completely cover the original surface with a one-coat application, but shall not be so that as to cause runs, sags, or a "plastered" effect.

The final surface after drying shall be uniform in color and texture, with no evidence of laps or breaks in continuity, and shall generally be lighter in color than the original concrete, but not white. Application of the Special Finish shall not be started until all work which might mar the surface finish has been completed, nor until the finish operations can be carried on continuously from beginning to completion on any one flat surface. Corrective work, as directed, will be required over any areas which have not been satisfactorily finished, including as much adjacent area as may be necessary to achieve uniform appearance, all at the Contractor's expense.

3.10 FINISHING UNFORMED SURFACES

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

3.10.1 General

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. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Joints shall be carefully made with a jointing or edging tool. 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. Slabs with surfaces which exhibit significant crazing shall be removed and replaced.

3.10.2 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. The concrete shall be 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.

3.10.3 Floated Finish

Screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. After the concrete has stiffened it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment.

3.10.4 Troweled Finish

The finished surface shall be thoroughly consolidated and shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks and be uniform in texture and appearance. 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. Tolerance shall be true planes within 5/16 inch in 10 feet as determined by a 10 foot straightedge placed anywhere on the slab in any direction.

3.10.5 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.

3.11 CURING AND PROTECTION

Concrete shall be cured by an approved method for a period of 7 days, except that cement blended with pozzolan shall be cured for 14 days.

3.11.1 General

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water. 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. In cold weather, follow curing procedures in Cold Weather Plan. In hot weather, follow curing in Hot Weather Plan.

3.11.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. When wooden forms are left in place during curing, they shall be kept wet at all times.

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. If inspection identifies 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.

3.11.3 Membrane forming Curing Compounds

Membrane curing will not be permitted on any surface to which sack-rubbed finish or smooth finish is to be applied. Membrane curing shall not be used on surfaces containing protruding steel reinforcement, or surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete, such as additional concrete, hardeners, sealers, terrazzo, or abrasive aggregate finish. Clear or translucent membrane-forming compound with fugitive dye shall be used on all surfaces permanently exposed to view, and white pigmented compound may be used on all other surfaces. 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. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam.

Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be thoroughly moistened with water. Curing compound

shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 75 psi, at a uniform coverage of not more than 400 square feet per gallon for each coat, and the second coat shall be applied perpendicular to the first coat. Allow preceding coat to completely dry prior to applying the next 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.

Appearance is a primary consideration for exterior concrete surfaces exposed to view. The Contractor shall exercise extreme care to apply curing compound evenly on these surfaces. Variations in shade, color, or tint, resulting from uneven application of curing compound, shall be repaired by and at the expense of the Contractor as directed.

3.11.4 Impervious Sheeting

Surfaces shall be thoroughly wetted and be completely covered with sheeting. Sheeting shall be at least 18 inches wider than the concrete surface to be covered. Covering shall be laid with light-colored side up. Covering shall be lapped not less than 12 inches and securely weighted down or shall be lapped not less than 4 inches and taped to form a continuous cover with completely closed joints. The sheet shall be weighted to prevent displacement so that it remains in contact with the concrete during the specified length of curing. Coverings shall be folded down over exposed edges of slabs and secured by approved means. If inspection identifies tears, holes, laps or joints that are not completely closed, the tears and holes shall immediately be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

3.11.5 Ponding or Immersion

Water shall not be more than 20 degrees F less than the temperature of the concrete.

3.12 GROUT

3.12.1 Grout Schedule of Use

- a. Nonshrink grout: Filling form tie holes, under column and beam base plates, other uses indicated on the Drawings.
- b. Epoxy grout: Patching cavities in concrete, grouting of dowels and anchor bolts into existing concrete, other uses indicated on the Drawings.

3.12.2 Grout Installation

a. Nonshrink grout: Clean concrete surface to receive grout. Saturate concrete with water for 24 HRS prior to grouting. Mix in a mechanical mixer. Use no more water than necessary to produce flowable grout. Place in accordance with manufacturer's instructions. Provide under beam, column, and equipment base plates, and in other locations indicated on the Drawings. Completely fill all spaces and cavities below the top of base plates. Provide forms where base plates and bed plates do not confine grout. Where exposed to view, finish grout edges smooth. Except where a slope is indicated on the Drawings, finish edges flush at the base plate, bed plate, member or piece of equipment. Coat exposed edges of grout with cure or seal compound recommended by the grout manufacturer.

b. Epoxy grout: Mix and place in accordance with manufacturer's instructions. Apply only to clean, dry, sound surface. Completely fill all cavities and spaces around dowels and anchors without voids. Grout base and bed plates as specified for nonshrink grout. Obtain manufacturer's field technical assistance as required to assure proper placement.

3.13 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor's Independent Testing Agency 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. If the Government conducts quality assurance testing, the Contractor shall assist in collection of samples as directed. All necessary platforms, tools, and equipment for obtaining samples shall be furnished by the Contractor.

3.13.1 Gradation

3.13.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis in accordance with ASTM C 136.

3.13.1.2 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.

3.13.2 Concrete Mixture

a. Air Content Testing. Air content tests shall be measured when compressive strength specimens are fabricated. Specified air content shall be attained at point of placement into the forms. Measurement shall be in accordance with ASTM C 231.

c. Slump Testing. The concrete slump shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 143. The slump shall be reported along with the compressive strength data.

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. Test cylinders shall be cast for compressive strength tests for each mix design at the following rates:

- a. not less than once each day when pour exceeds 8 cubic yards.
- b. not less than once for each 125 cubic yards of concrete.
- c. the number of test cylinders need not exceed 3 sets per day for each mix.

A set of test specimens shall consist of four cylinders, one to be tested at 7 days and two at 28 days. If either of the 28 day breaks does not meet the specified strength, the fourth cylinder shall be tested at 90 days, otherwise it shall be discarded. Test specimens shall be molded and cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Results of all strength tests shall be reported immediately to the Contracting Officer.

3.13.3 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. Full cooperation shall be given other trades to install embedded items. Suitable templates or instructions shall be used for setting items not placed in the forms.

3.13.4 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.

3.13.5 Reports

The results of all tests and inspections conducted at the project site, as well as corrective actions taken, shall be reported in writing weekly and shall be delivered to the quality assurance representative within three days after the end of each weekly reporting period. The Contracting Officer has the right to examine all Contractor quality control records.

-- End of Section --

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SECTION 03360

SIMULATED STONE MASONRY
04/01

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 1308 | (1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes |
| ASTM D 3359 | (1997) Measuring Adhesion by Tape Test |
| ASTM G 23 | (1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic 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 in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Simulated Stone Masonry; GA

Plan, elevation and details to show overall pattern, joint locations, form tie locations, and end, edge and other special conditions.

SD-14 Samples

Panel; FIO

Within 30 days of receiving the general contract General Contractor is required to submit a 24 inch x 24 inch sample of each the simulated stone masonry finishes. Sample is to demonstrate the finish described in paragraph DESIGN REQUIREMENTS. Approval of sample panel is required by Architect/Engineer and Owner.

Form Ties; FIO

Form ties, sample and description, showing method of separation when forms are removed.

1.3 DESIGN REQUIREMENTS

Design and pattern of the concrete surface shall follow the manufacturer's standard drawing. If an actual stone surface or stone wall to be matched is available, the completed colored and formed concrete surface shall match the natural material as closely as possible. See Section 04200 MASONRY for stone type. Patterning of simulated stone masonry shall appear natural and non-repeating. Seam lines or match lines caused from two of more molds coming together will not be apparent when viewing final wall. Final coloration of cast stone concrete surface shall accurately simulate the appearance of real stone including the multiple colors, shades, flecking, and veining that is apparent in real stone. It shall also demonstrate the colors that may be apparent from aging, such as staining from oxidation, rusting and/or organic staining from soil and/or vegetation. Note that in paragraph SUBMITTAL and Part 3, EXECUTION, a sample and mockup are required. Upon approval by Architect/Engineer and Owner, mockup shall serve as quality standard for the project.

1.4 QUALITY ASSURANCE

Manufacturer of simulated stone masonry molds and custom coloring system shall have 5 years experience making stone masonry molds and color stains to create formed concrete surfaces to match natural stone shapes, surface textures and colors.

Pre-installation meeting: Schedule conference with manufacturer representative to ensure understanding of simulated stone masonry molds use, color application, requirements for construction of mockup, and to coordinate the work.

1.5 PROJECT CONDITIONS

Environmental requirements: Apply color stain when ambient temperatures are between 50 and 100 degrees F. Consult manufacturer if conditions differ from this requirement.

1.6 SEQUENCING

Schedule color stain application with earthwork and backfilling of any wall areas making sure that all simulated stone texture is colored to the minimum distance below grade. Delay adjacent plantings until color application is completed. Coordinate work to permit coloring applications without interference from other trades.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Simulated Stone Masonry Molds

Reusable, made of high-strength urethane, easily attachable to forms. Molds shall not compress more than 1/4 inch when concrete is poured at rate of 10 vertical feet per hour. Molds shall be removable without causing deterioration of surface or underlying concrete.

- a. Floodwall form liner: Custom Rock Form Liner #11016, Random Cut Stone, as manufactured by Custom Rock International, Scott System, Inc. or approved equal.

2.1.2 Release Agent

Compatible with simulated stone masonry molds and with color stain system to be applied to surface. Consult manufacturer.

2.1.3 Form Ties

Form ties shall be made of either metal or fiberglass. Using metal ties which result in a portion of the tie permanently embedded in the concrete shall be designed to separate at least 1 inch back from finished surface, leaving only a neat hole that can be plugged with patching material. Contractor shall submit the type of form ties to the Engineer, project designer or Owner for approval prior to use in this work.

2.1.4 Mortar Joints

Joints shall be colored to simulate real mortar.

2.1.5 Color Stain

CRI pigmented stain is a special penetrating stain mix, as provided by manufacturer, and shall achieve color variations present in the natural stone being simulated for this project, as required by Architect/Engineer and Owner as referenced in paragraph DESIGN REQUIREMENTS. Stain shall create a surface finish that is breathable (allowing water vapor transmission), and that resists deterioration from water, acid, alkali, fungi, sunlight or weathering. Stain mix shall be a water borne, low V.O.C. material, less than 289 grams/liter, and shall meet requirements for weathering resistance of 2000 hours accelerated exposure measured by weather-o-meter in accordance with ASTM G 23. Scrub test 1000 revolutions. Abrasive resistance (Tabor-CF-10) 500 cycles. Adhesion ASTM D 3359 1.00MM cross cuts on glass pass 3 or higher on a scale of 1 to 5. Supply information pertaining to chemical resistance ASTM D 1308 to 87.

PART 3 EXECUTION

3.1 ACCEPTABLE INSTALLERS

3.1.1 Formed Concrete Construction

Five years experience pouring vertically formed architectural concrete. Installer shall be trained in manufacturer's special techniques in order to achieve realistic surfaces.

3.1.2 Color Stain System Application

Manufacturer or manufacturer's authorized representative.

3.2 CONSTRUCTION

Mockup: Build on site sixty days before work starts, using same materials, methods and work force that will be used for the project.

Architect/Engineer and Owner will determine specific requirements and location, and whether mockup shall be incorporated into the project.

1. Size: 50 square feet, or larger if needed to adequately illustrate the pattern and texture selected.

2. Include an area to demonstrate wall mold butt joint and if appropriate, continuation of pattern through expansion joint.

3. If design includes stone texture across top of wall, include in mockup.

4. After concrete work on mockup is completed and cured for a minimum of 28 days, and after surface is determined to be acceptable for coloring, apply color stain system.

5. After coloring is determined to be acceptable by the Architect/Engineer and Owner, construction of project may proceed, using mockup as quality standard.

3.3 SPECIAL TECHNIQUES

3.3.1 Forming Textured Concrete

For preparation, clean simulated stone masonry molds and make free of buildup prior to each pour. Inspect for blemishes or tears. Repair if needed following manufacturer's recommendations. Place stone molds with less than 1/4 inch separation between them. Attach molds to form securely following manufacturer's recommendations. Apply form release agent following manufacturers' recommendations. Form stripping and related construction shall avoid creating defects in finished surface. If the pattern selected has molds connecting through the middle of the stones, carefully remove the seam line created by abutting molds. Match the texture and shape of the surrounding stone, avoiding visible seams or mold marks. Place form ties at thinnest points of molds (high points of finished wall). Neatly patch the hole remaining after disengaging the protruding portion of the tie so that it will not be visible after coloring the concrete surface.

Where an expansion joint must occur at a point other than at mortar or rustication joints, such as at the face of concrete texture which is to have the appearance of stone, consult manufacturer for proper treatment of expansion material.

3.3.2 Applying Color Stain System

All simulated stone surfaces that are to be stained and any patching that

has been done in these areas shall be at least 30 days old. Clean surface prior to application of stain materials to assure that surface is free of latency, dirt, dust, grease, efflorescence, paint, or other foreign material, following manufacturer's instructions for surface preparation. Do not sandblast. Preferred method to remove latency is pressure washing with water, minimum 3000 psi (a rate of 3 to 4 gallons per minute), using fan nozzle perpendicular to and at a distance of 1 or 2 feet from surface. Completed surface shall be free of blemishes, discoloration, surface voids and unnatural form marks.

3.4 PROTECTION

Where exposed soil or pavement is adjacent which may spatter dirt or soil from rainfall, or where surface may be subject to over spray from other processes, provide temporary cover of completed work.

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SECTION 04200

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SECTION 04200

MASONRY
04/01

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 (1997a) Steel Wire, Plain, for Concrete Reinforcement

ASTM A 153/A 153M (1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 615/A 615M (1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM C 55 (1997a) Concrete Brick

ASTM C 62 (1997a) Building Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C 67 (1998a) Sampling and Testing Brick and Structural Clay Tile

ASTM C 90 (1998) Loadbearing Concrete Masonry Units

ASTM C 91 (1998) Masonry Cement

ASTM C 126 (1996) Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units

ASTM C 129 (1997) Nonloadbearing Concrete Masonry Units

ASTM C 140 (1998b) Sampling and Testing Concrete Masonry Units

| | |
|-------------|---|
| ASTM C 216 | (1998) Facing Brick (Solid Masonry Units Made from Clay or Shale) |
| ASTM C 270 | (1997a ^{el}) Mortar for Unit Masonry |
| ASTM C 476 | (1998) Grout for Masonry |
| ASTM C 494 | (1998) Chemical Admixtures for Concrete |
| ASTM C 578 | (1995) Rigid, Cellular Polystyrene Thermal Insulation |
| ASTM C 641 | (1982; R 1991) Staining Materials in Lightweight Concrete Aggregates |
| ASTM C 652 | (1997) Hollow Brick (Hollow Masonry Units Made From Clay or Shale) |
| ASTM C 744 | (1998) Prefaced Concrete and Calcium Silicate Masonry Units |
| ASTM C 780 | (1996) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry |
| ASTM C 1019 | (1989a; R 1998) Sampling and Testing Grout |
| ASTM C 1072 | (1998) Measurement of Masonry Flexural Bond Strength |
| ASTM C 1289 | (1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board |
| ASTM D 2000 | (1998c) Rubber Products in Automotive Applications |
| ASTM D 2240 | (1997e ^l) Rubber Property - Durometer Hardness |
| ASTM D 2287 | (1996) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds |
| ASTM E 119 | (1998) 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 a "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Clay or Shale Brick; GA. Concrete Masonry Units (CMU); GA. Insulation; GA. Stone Items; GA.

Manufacturer's descriptive data.

SD-14 Samples

Concrete Masonry Units (CMU); GA. Stone Items; GA. Clay or Shale Brick; GA. Precast Concrete Items; GA.

Color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture.

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 leg of an L-shaped panel shall be 4 feet long by 6 feet high.

One sample masonry panel shall be constructed to represent pump stations K7, K10, L1, and L2. No other panels will be required for any other structure.

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, 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, insulation, flashing, brick soldier and weep holes shall be shown in the sample panels. The panels shall contain a masonry bonded corner.

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. In addition, glass block units and prefaced concrete units shall be stored with their finish surfaces covered. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.4.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

1.4.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval.

2.1.1 General

Products identified in this Section by reference to a specific manufacturer and product name/number are identified for the purpose of establishing a standard of quality, type, and function. Products of other manufacturers may be submitted for those listed, provided that the substitution is equal in quality, type, and function and meets the specified requirements. Units shall conform to the requirements specified below.

2.2 CLAY OR SHALE BRICK

Color range and texture of clay or shale brick shall be as indicated and shall conform to the approved sample. Grade SW shall be used for brick in contact with earth or grade and for all exterior work. 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.

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. Units shall conform to the requirements specified below.

2.2.1 Brick Veneer Type 1 (FBR-1)

Brick facing for pump station K-12 and its associated tie-in walls and gatewell shall match that of the adjacent flood wall to the north. A sample shall be submitted to the government for approval. For Contractors information only, the brick used in the adjacent floodwall is a "used Chicago common" supplied by Strata Block and Masonry, 1625 North 36th Street, Grand Forks, ND 58203. Point of contact at Strata Block and Masonry is Mark Flaten at (701) 775-8144, fax (701) 775-8123.

2.2.2 Brick Veneer Type 2 (FBR-2)

Brick shall conform to ASTM C 216, Type FBR. Brick shall be modular and the nominal size of the brick shall be 4 inches thick, 4 inches wide, and 12 inches long. Minimum compressive strength of the brick shall be 2,500 psi. Provide 12" utility, beige gray smooth, supplied by Sioux City Brick and Tile Company, 310 S. Floyd Blvd., Sioux City, Iowa 51102, at (712) 2587-6571, fax (712) 252-3215. Acceptable substitution shall match size, compressive strength, and color as described.

2.3 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 90, Type I. Cement shall have a low alkali content and be of one brand.

2.3.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

2.3.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

Concrete masonry units indicated shall be supplied by Anchor Block and Concrete Company, 2300 McKnight Road, North St. Paul, MN 55109 at (651) 777-8321, Fax (651) 777-0169. Acceptable substitution must match size, shapes, texture, and color as described.

2.3.2.1 CMU-1

Standard Concrete Masonry Unit, Natural Gray Color (Anchor Block 1200)

2.3.2.2 CMU-2

4" veneer rock face (Anchor Block 402RF). Integral color; one color shall be selected for pump stations K7, K10, L1 and L2. A second color may be selected for pump station K12.

2.3.2.3 CMU-3

Crescent face sill accent (Anchor Block 0461CF); Integral color.

2.3.2.4 CMU-5

Solid CMU 6 x 8 x 16 (Anchor Block 690). Integral color; one color shall be selected for pump stations K7, K10, L1, and L2. A second color may be selected for pump station K12.

2.3.2.5 CMU-6

Beveled accent sill 6 x 8 x 16. (Anchor Block 06580402). Integral color.

2.3.2.6 Burnished Block

Anchor block "Custom Series" color, 8 x 16 face.

2.4 STONE ITEMS

Stone for veneer facing and wall coping shall be limestone and shall be cut to the design shown. Limestone shall be natural, deep ledge quarried limestone. Stone shall have beds and joints at right angles to the face, with sharp, true arises. Copings and sills shall be provided with washes, and where overhanging the walls, shall have drips cut on the underside.

Stone items indicated shall be supplied by Mankato Kasota Stone, Inc., 818 North Willow Street, Mankato, MN 56001, (507) 625-2746, Fax (507) 625-2748.

Acceptable substitution must match limestone properties, sizes, color range, finish, and patterns as described.

2.4.1 Ashlar Stone (STN-1)

Provide random ashlar split stone comprised of course heights of approximately 15% 2-1/8", 40% 4-7/8", 35% 7-1.2", 10% 10-1/8", with color mix of 34% golden buff, 34% grey, and 32% cream; Mankato-Kasota Stone "Church Mix" pattern, split face.

2.4.2 Keystone (STN-2)

Not Used.

2.4.3 Overlook Wall Cap Stone (STN-3)

Provide cut stone piece(s) as detailed; Mankato-Kasota stone, cream fleuri, tapestry finish.

2.5 PRECAST CONCRETE ITEMS

Keystone accent pieces shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 4000 psi minimum conforming to Section 03300: CAST-IN-PLACE STRUCTURAL CONCRETE using 1/2 inch to No.4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Clearance of 3/4 inch shall be maintained between reinforcement and faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 120 pounds per square inch for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days or longer. Cast-concrete members weighing over 80 pounds shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises 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. Exposed front face of unit shall be tooled or bush hammered: use power or hand tools to achieve a "rock-face" or "split-face texture". Units shall be integrally colored during manufacture as selected by Contracting Officer from manufacturer's standard colors. 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.

2.6 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; Type N cement-lime mortar proportions shall be 1 part cement, 1 part lime and 6 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C 780 and ASTM C 1072. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

2.6.1 Admixtures

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

2.6.2 Coloring

Mortar coloring shall be added to the mortar used for integrally colored exposed masonry surfaces to produce a uniform color. Mortar coloring shall not exceed 3 percent of the weight of cement for carbon black and ten percent of the weight of cement for all other pigments. Mortar coloring shall be chemically inert, of finely ground limeproof pigment, and furnished in accurately pre-measured and packaged units that can be added to a measured amount of cement. Mortar coloring shall be added to the mortar used for exposed exterior masonry at pump stations K7, K10, L1, and L2. Mortar shall be standard grey for brick veneer and colored for cmu veneer at pump station K12.

2.7 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 8 and 10 inches. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

2.7.1 Admixtures

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

2.7.2 Grout Barriers

Grout barriers for vertical cores shall consist of fine mesh wire, fiberglass, or expanded metal.

2.8 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/A 153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to

ASTM A 82. Anchors and ties shall be sized to provide a minimum of 5/8 inch mortar cover from either face.

2.8.1 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 3/16 inch diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 4 inches wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 3/16 inch diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 1/2 inch eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 1/16 inch. The pintle and eye elements shall be formed so that both can be in the same plane.

2.8.2 Dovetail Anchors

Dovetail anchors shall be of the flexible wire type, 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.

2.9 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/A 153M, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 5/8 inch cover from either face. The distance between crosswires shall not exceed 16 inches. Joint reinforcement for straight runs shall be furnished in flat sections not less than 10 feet long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

2.10 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615/A 615M, Grade 60.

2.11 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07900JOINT

SEALING.

2.12 INSULATION

2.12.1 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.

2.12.1.1 Insulation Thickness and Air Space

The cavity space shall allow for a maximum insulation thickness of 2 inches, and a minimum air space of 2 inches.

2.12.1.2 Aged R-Value

The insulation shall provide a minimum aged R-value of 11 for the overall thickness. The aged R-value shall be determined at 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.

2.12.1.3 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.

2.12.2 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.

2.13 FLASHING

2.13.1 Rubberized Asphalt Sheet Flashing

Self-sealing, self-healing, fully adhering composite flexible flashing, consisting of pliable, highly adhesive, rubberized asphalt, bonded completed, and integrally to multiple plies of 8 mil (minimum) high density cross laminated polyethylene film, 40 mil thick total (minimum), protected by release sheet. Include primer, surface conditioner, mastic, and other

accessories as recommended by the manufacturer.

2.14 WEEP HOLE VENTILATORS

Weephole ventilators shall be prefabricated aluminum grill type vents designed to prevent insect entry with maximum air entry. Ventilators shall be sized to match modular construction with a standard 3/8 inch mortar joint.

2.15 SURFACE TREATMENTS

2.15.1 Water Repellant for Exterior Concrete Masonry

Clear, penetrating, breathable water repellant that bonds with silica with the following characteristics:

- (1) Active substance: alkyltrialkoxo silanes.
- (2) Denatured ethanol alcohol.
- (3) Active content: 20 percent.
- (4) Density: 6.7 pounds per gallon.

2.15.2 Burnished Block Sealer

Block manufacturer's standard sealer.

2.16 CAVITY DRAINAGE MATERIAL

Mortar nets: lightweight polyethylene or nylon net (90 percent open woven mesh), allowing water to flow through mortar droppings.

PART 3 EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 99 degrees F in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 4 feet ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 40 degrees F, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

- a. Air Temperature 40 to 32 Degrees F. Sand or mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F.
- b. Air Temperature 32 to 25 Degrees F. Sand and mixing water shall be heated to produce mortar temperatures between 40 degrees F and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing.
- c. Air Temperature 25 to 20 Degrees F. Sand and mixing water shall be heated to provide mortar temperatures between 40 degrees F and 120 degrees F. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 15 mph.
- d. Air Temperature 20 Degrees F and below. Sand and mixing water shall be heated to provide mortar temperatures between 40 degrees F and 120 degrees F. Enclosure and auxiliary heat shall be provided to maintain air temperature above 32 degrees F. Temperature of units when laid shall not be less than 20 degrees F.

3.1.2.2 Completed Masonry and Masonry Not Being Worked On

- a. Mean daily air temperature 40 degrees F to 32 degrees F. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.
- b. Mean daily air temperature 32 degrees F to 25 degrees F. Masonry shall be completely covered with weather-resistant membrane for 24 hours.
- c. Mean Daily Air Temperature 25 Degrees F to 20 Degrees F. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.
- d. Mean Daily Temperature 20 Degrees F and Below. Masonry temperature shall be maintained above 32 degrees F for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running 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 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 selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work. Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. In double wythe construction, the inner wythe may be brought up not more than 16 inches ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 8 inches.

3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 1/8 inch. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

3.2.4 Clay or Shale Brick Units

Brick facing shall be laid with the better face exposed. Brick shall be laid in running bond with each course bonded at corners, unless otherwise indicated. 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 1 gram per minute per square inch of bed surface shall be in conformance with ASTM C 67. The method of wetting shall ensure that each unit is nearly saturated but surface dry when laid.

3.2.4.2 Solid Units

Bed, head, and collar joints shall be completely filled with mortar.

3.2.4.3 Hollow Units

Hollow units shall be laid as specified for concrete masonry units.

3.2.5 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II

TOLERANCES

Variation from the plumb in the lines
and surfaces of columns, walls and arises

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

Variations from the plumb for external corners,
expansion joints, and other conspicuous lines

| | |
|--------------------|----------|
| In 20 feet | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variations from the level for exposed lintels,
sills, parapets, horizontal grooves, and other

TOLERANCES

conspicuous lines

| | |
|--------------------|----------|
| In 20 feet | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variation from level for bed joints and top surfaces of bearing walls

| | |
|--------------------|----------|
| In 10 feet | 1/4 inch |
| In 40 feet or more | 1/2 inch |

Variations from horizontal lines

| | |
|--------------------|----------|
| In 10 feet | 1/4 inch |
| In 20 feet | 3/8 inch |
| In 40 feet or more | 1/2 inch |

Variations in cross sectional dimensions of columns and in thickness of walls

| | |
|-------|----------|
| Minus | 1/4 inch |
| Plus | 1/2 inch |

3.2.6 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

3.2.7 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

3.2.7.1 Flush Joints

Joints in concealed masonry surfaces, joints located behind ceramic tile base, 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 unpared 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 unless otherwise noted. Joints shall be tooled with a jointer slightly larger than the joint width so that complete contact is made along the edges of the unit. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed. Jointer of sufficient length shall be used to obtain a straight and true mortar joint.

3.2.7.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.2.8 Joint Widths

Joint widths shall be as follows:

3.2.8.1 Concrete Masonry Units

Concrete masonry units shall have 3/8 inch joints.

3.2.8.2 Brick

Brick joint widths shall be the difference between the actual and nominal dimensions of the brick in either height or length. Brick control 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. Tothing 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.

3.3 ANCHORED VENEER CONSTRUCTION

The inner and outer wythes shall be completely separated by a continuous airspace as shown on the drawings. Both the inner and the outer wythes shall be laid up together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, through-wall flashings shall be protected from damage until they are fully enclosed in the wall. The airspace between the wythes shall be kept clear and free of mortar droppings by temporary wood strips laid on the wall ties and carefully lifted out before placing the next row of ties.

A coarse gravel or drainage material shall be placed behind the weep holes in the cavity to a minimum depth of 4 inches of coarse aggregate or 10 inches of drainage material to keep mortar droppings from plugging the weep holes.

3.4 WEEP HOLES

Weep holes shall be provided not more than 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 formed by placing short lengths of well-greased No. 10, 5/16 inch nominal diameter, braided cotton sash cord in the mortar and withdrawing the cords after the wall has been completed. Other approved methods may be used for providing weep holes. Weep holes shall be kept free of mortar and other obstructions.

3.5 COMPOSITE WALLS

Masonry wythes shall be tied together with joint reinforcement or with unit wall ties. Facing shall be anchored to concrete backing with galvanized wire dovetail anchors set in slots built in the face of the concrete as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The facing wythe shall be anchored or tied to the backup at a maximum spacing of 16 inches on center vertically and 24 inches on center horizontally. Unit ties shall be spaced not over 24 inches on centers horizontally, in courses not over 16 inches apart vertically, staggered in alternate courses. Ties shall be laid not closer than 5/8 inch to either masonry face. Ties shall not extend through control joints. Collar joints between masonry facing and masonry backup shall be filled solidly with grout.

3.6 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.

3.7 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 2 inches of tops of walls.

3.7.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 1/2 inch shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

3.7.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

3.8 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 16 inches on center or as indicated. Reinforcement shall be lapped not less than 6 inches. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 5/8 inch cover to either face of the unit.

3.9 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.

3.9.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.9.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

3.9.3 Grouting Equipment

3.9.3.1 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.

3.9.3.2 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.

3.9.4 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 5 feet in height. High-lift grout methods shall be used on pours exceeding 5 feet in height.

3.9.4.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 1/2 inch into the grout space shall be removed before beginning the grouting operation. Grout pours 12 inches or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 12 inches in height shall be consolidated by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be

inserted into lower pours that are in a semi-solidified state. Low lift grout shall be used subject to the limitations of Table III.

3.9.4.2 High-Lift Method

Mortar droppings shall be cleaned from the bottom of the grout space and from reinforcing steel. Mortar protruding more than 1/4 inch into the grout space shall be removed by dislodging the projections with a rod or stick as the work progresses. Reinforcing, bolts, and embedded connections shall be rigidly held in position before grouting is started. CMU units shall not be pre-wetted. Grout, from the mixer to the point of deposit in the grout space shall be placed as rapidly as practical by pumping and placing methods which will prevent segregation of the mix and cause a minimum of grout splatter on reinforcing and masonry surfaces not being immediately encased in the grout lift. The individual lifts of grout shall be limited to 4 feet in height. The first lift of grout shall be placed to a uniform height within the pour section and vibrated thoroughly to fill all voids. This first vibration shall follow immediately behind the pouring of the grout using an approved mechanical vibrator. After a waiting period sufficient to permit the grout to become plastic, but before it has taken any set, the succeeding lift shall be poured and vibrated 12 to 18 inches into the preceding lift. If the placing of the succeeding lift is going to be delayed beyond the period of workability of the preceding, each lift shall be reconsolidated by reworking with a second vibrator as soon as the grout has taken its settlement shrinkage. The waiting, pouring, and reconsolidation steps shall be repeated until the top of the pour is reached. The top lift shall be reconsolidated after the required waiting period. The high-lift grouting of any section of wall between vertical grout barriers shall be completed to the top of a pour in one working day unless a new series of cleanout holes is established and the resulting horizontal construction joint cleaned. High-lift grout shall be used subject to the limitations in Table III.

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

| Maximum Grout Pour Height (feet) (4) | Grout Type | Grouting Procedure | Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (in.) (1,2) | |
|---|---------------|-----------------------|---|------------------------|
| | | | Multiwythe Masonry (3) | Hollow-unit Masonry |
| 1 | Fine | Low Lift | 3/4 | 1-1/2 x 2 |
| 5 | Fine | Low Lift | 2 | 2 x 3 |
| 8 | Fine | High Lift | 2 | 2 x 3 |
| 12 | Fine | High Lift | 2-1/2 | 2-1/2 x 3 |
| 24 | Fine | High Lift | 3 | 3 x 3 |
| 1 | Coarse | Low Lift | 1-1/2 | 1-1/2 x 3 |

TABLE III

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|---|---------------|-----------------------|---|------------------------|
| | | | Multiwythe Masonry (3) | Hollow-unit Masonry |
| 5 | Coarse | Low Lift | 2 | 2-1/2 x 3 |
| 8 | Coarse | High Lift | 2 | 3 x 3 |
| 12 | Coarse | High Lift | 2-1/2 | 3 x 3 |
| 24 | Coarse | High Lift | 3 | 3 x 4 |

Notes:

- (1) The actual grout space or cell dimension must be larger than the sum of the following items:
 - a) The required minimum dimensions of total clear areas given in the table above;
 - b) The width of any mortar projections within the space;
 - c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.
- (2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 3/4 inch or greater in width.
- (3) For grouting spaces between masonry wythes.
- (4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

3.10 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units.

3.11 BRICK CONTROL JOINTS AND CONCRETE MASONRY VENEER JOINTS

Brick control 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.

3.12 SHELF ANGLES

Shelf angles shall be adjusted as required to keep the masonry level and at the proper elevation. Shelf angles shall be galvanized. Shelf angles shall be provided in sections not longer than 10 feet and installed with a 1/4 inch gap between sections. Shelf angles shall be mitered and welded at building corners with each angle not shorter than 4 feet, unless limited by wall configuration.

3.13 LINTELS

3.13.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 1/2 inch above the bottom inside surface of the lintel unit.

3.13.2 Precast Concrete and Steel Lintels

Precast concrete and steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of 8 inches unless otherwise indicated on the drawings.

3.14 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

3.15 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

3.15.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 16 inches on centers vertically and 24 inches on center horizontally.

3.16 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.

3.17 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.

3.17.1 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.

3.17.2 Clay or Shale Brick Surfaces

Exposed clay or shale brick masonry surfaces shall be cleaned as necessary to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. After cleaning, the sample panel of similar material shall be examined for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, the method of cleaning shall be changed to assure that the masonry surfaces in the structure will not be adversely affected. The exposed masonry surfaces shall be water-soaked and then cleaned with a solution proportioned 1/2 cup trisodium phosphate and 1/2 cup laundry detergent to one gallon of water or cleaned with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay products manufacturer. The solution shall be applied with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence shall be removed in conformance with the brick manufacturer's recommendations.

3.18 WATER REPELLANT

Tuck point and repair cracks or nail holes 1/32 of an inch or larger in any dimension. After concrete masonry has been cleaned and allowed to cure a minimum of 30 days, apply water repellent to exterior concrete masonry work in accordance with manufacturer's instructions.

3.19 SEALING

After concrete masonry has been cleaned and allowed to cure, seal burnished concrete masonry work with one coat of specified sealer applied in strict accordance with manufacturer's recommendations.

3.20 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 03300CAST-IN-PLACE STRUCTURAL CONCRETE.

3.21 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

3.22 TEST REPORTS

3.22.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 1/2 to 5/8 inch thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

3.22.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 2000 psi at 28 days.

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SECTION 05055

METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS
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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 SAS-30 (1986) Aluminum Structures Constructino Manual Series - Section 1 Specifications for Aluminum Structures

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A 14.3 (1992) Ladders-Fixed-Safety Requirements

ANSI MBG 531 (1993) Metal Bar Grating Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6 (1999) General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use

ASTM A 36 (1997) Carbon Structural Steel

ASTM A 53 (1996) 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 153 (1995) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 276 (1996) Stainless and Heat-Resisting Steel Bars and Shapes

ASTM A 307 (1997) 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 380 | (1994a) Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems |
| ASTM A 449 | (2000) Standard Specification for Quenched and Tempered Steel Bolts and Nuts |
| ASTM A 500 | (1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes |
| ASTM A 563 | (1996) Specification for Carbon and Alloy Steel Nuts |
| ASTM A 564 | (1995) Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes |
| ASTM A 569 | (1998) Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality |
| ASTM A 572 | (1997) Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel |
| ASTM A 1011 | (2000) Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability |
| ASTM B 221 | (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes |
| ASTM 308 | (1995a) Aluminum-Alloy 6061-T6 Standard Structural Shapes |
| ASTM F 593 | (1998) Stainless Steel Bolts, Hex Cap Screws, and Studs |
| ASTM F 594 | (1998) Stainless Steel Nuts |
| ASTM B 429 | (1995) Aluminum-Alloy Extruded Structural Pipe and Tube |
| ASTM A 780 | (1993a) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings |
| ASTM D 395 | (1989; R 1994) Rubber Property - Compression Set |
| ASTM D 412 | (1992) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension |

ASTM D 413 (1982; R 1993) Rubber Property - Adhesion to Flexible Substrate

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

ASTM D 572 (1988; R 1994) Rubber - Deterioration by Heat and Oxygen

ASTM D 2240 (1995) Rubber Property - Durometer Hardness

ASTM E 32 (1996) Practices for Sampling Ferroalloys and Steel Additives for Determination of Chemical Composition

ASTM E 165 (1995) Liquid Penetrant Examination Inspection Method

ASTM E 709 (1995) Magnetic Particle Examination

ASTM F 436 (1993) Specification for Hardened Steel Washers

ASME INTERNATIONAL (ASME)

ASME B4.1 (1967; R 1994) Preferred Limits and Fits for Cylindrical Parts

ASME B18.2.2 (1989; R 1993) Square and Hex Nuts (Inch Series)

ASME B18.3 (1989; R 1995) Socket Cap, Shoulder and Set Screws (Inch Series) Including Dimensions of Hexagon and Spline Sockets

ASME B18.6.2 (1972; R 1993) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws

ASME B18.6.3 (1972; R 1991) Machine Screws and Machine Screw Nuts

ASME B18.21.1 (1994) Lock Washers (Inch Series)

ASME B18.22.1 (1965; R 1990) Plain Washers

ASME B18.22M (1981; R 1990) Metric Plain Washers

ASME B27.7 (1977; R 1993) General Purpose Tapered and Reduced Cross Section Retaining Rings

ASME BPV IX (1995) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing

Qualifications

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531 (1993) Metal Bar Grating Manual
 NAAMM MBG 532 (1988) Heavy Duty Metal Bar Grating Modulal

AMERICAN WELDING SOCIETY (AWS)

AWS C5.5 (1980) Recommended Practices for Gas Tungsten Arc Welding
 AWS D1.1 (2000) Structural Welding Code - Steel
 AWS D1.2 (1990) Structural Welding Code-Aluminum

U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH
ADMINISTRATION (OSHA)

OSHA 29 CFR 1910 OSHA Safety and Health Standard for
 General Industry

1.2 SUBMITTALS

Government approval is required for all 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

Detail Drawings; GA.

Detail drawings for metalwork and machine work shall be submitted and approved prior to fabrication.

SD-07 Schedules

Materials Orders; FIO.

Copies of purchase orders, mill orders, shop orders and work orders for materials shall be submitted prior to the use of the materials in the work.

Materials List; FIO.

Materials list for fabricated items shall be submitted at the time of submittal of detail drawings.

Shipping Bill; FIO.

Shipping bill shall be submitted with the delivery of finished pieces to the site.

SD-08 Statements

Welding Procedures for Structural Steel; FIO.

Schedules of welding procedures for steel structures shall be submitted and approved prior to commencing fabrication.

Welding of Aluminum; FIO.

Schedules of welding processes for aluminum fabrications shall be submitted and approved prior to commencing fabrication.

Structural Steel Welding Repairs; FIO.

Welding repair plans for steel shall be submitted and approved prior to making repairs.

SD-09 Reports

Tests, Inspections, and Verifications; FIO.

Certified test reports for materials shall be submitted with all materials delivered to the site.

SD-13 Certificates

Qualification of Welders and Welding Operators; FIO.

Certifications for welders and welding operators shall be submitted prior to commencing fabrication.

Application Qualification for Steel Studs; FIO.

Certified reports for the application qualification for steel studs shall be submitted and approved prior to commencing fabrication.

Welding of Aluminum; FIO.

Certified report for aluminum welding qualification tests shall be submitted and approved prior to commencing welding.

SD-18 Records

Materials Disposition Records; FIO.

Materials disposition records shall be submitted before completion of contract.

1.3 METALWORK AND MACHINE WORK DETAIL DRAWINGS

Detail drawings for metalwork and machine work shall include catalog cuts, templates, fabrication and assembly details and type, grade and class of material as appropriate. Elements of fabricated items inadvertently omitted on contract drawings shall be detailed by the fabricator and

indicated on the detail drawings.

1.4 QUALIFICATION OF WELDERS AND WELDING OPERATORS

The Contractor shall certify that the qualification of welders and welding operators and tack welders who will perform structural steel welding have been qualified for the particular type of work to be done in accordance with the requirements of AWS D1.1, or ASME BPV IX, Section IX, prior to commencing fabrication. The certificate shall list the qualified welders by name and shall specify the code and procedures under which qualified and the date of qualification. Prior qualification will be accepted if welders have performed satisfactory work under the code for which qualified within the preceding three months. The Contractor shall require welders to repeat the qualifying tests when their work indicates a reasonable doubt as to proficiency. Those passing the requalification tests will be recertified. Those not passing will be disqualified until passing. All expenses in connection with qualification and requalification shall be borne by the Contractor.

1.5 DELIVERY, STORAGE AND HANDLING

Galvanized steel items shall be stored in a dry location with spacers to separate the pieces from the ground and each other.

1.5.1 Rubber Seals

Rubber seals shall be stored in a place which permits free circulation of air, maintains a temperature of 70 degrees F or less, and prevents the rubber from being exposed to the direct rays of the sun. Rubber seals shall be kept free of oils, grease, and other materials which would deteriorate the rubber. Rubber seals shall not be distorted during handling.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Materials Orders

The Contractor shall furnish 3 copies of purchase orders, mill orders, shop orders and work orders for all materials orders and items used in the work.

Where mill tests are required purchase orders shall contain the test site address and the name of the testing agency.

2.1.2 Materials List

The Contractor shall furnish a materials list of the materials to be used in the fabrication of each item.

2.1.3 Shipping Bill

The Contractor shall furnish a shipping bill or memorandum of each shipment of finished pieces or members to the project site giving the designation mark and weight of each item, the number of items, the total weight, and the car initial and number if shipped by rail in carload lots. Duplicate

copies of shipping bills shall be mailed promptly to the Contracting Officer.

2.1.4 Miscellaneous Metals and Standard Articles

2.1.4.1 Structural Steel

ASTM A 36, or ASTM A 572, Grade 50, as indicated. Galvanized after fabrication.

2.1.4.2 Steel Tubing

ASTM A 500, Grade B, welded, outside dimensions and nominal wall thickness as shown. Galvanized after fabrication.

2.1.4.3 Steel Pipe and Pipe Fittings

ASTM A 53, Type E, Grade B, electric-resistance welded, galvanized, nominal size and weight class or outside diameter and nominal wall thickness as shown with plain ends.

2.1.4.4 Bars and Shapes

Stainless steel bars and shapes shall conform to the following as specified or shown:

- a. ASTM A 276, UNS S30400, Condition A, hot-finished or cold-finished, Class C.
- b. ASTM A 564, UNS S17400 or S45000, age-hardened heat treatment condition, hot-finished or cold-finished, Class C.

2.1.4.5 Threaded Rod

Steel Rod

ASTM A 449, galvanized after fabrication.

Stainless Steel Rod

ASTM A 276, Strain hardened, type 316 with minimum yield strength of 75 ksi and minimum ultimate strength of 95 ksi.

2.1.4.6 Bolts, Nuts, and Washers

Bolts, nuts, and washers shall be of the material, grade, type, class, style and finish indicated or best suited for intended use.

High-Strength Bolts, Nuts, and Washers

Bolts: ASTM A 325, Type 1, hot-dip galvanized.
Nuts: ASTM A 563, hot-dip galvanized.

Bolts, Nuts, and Washers (Other than High-Strength)

- a. Bolts and Nuts - ASTM A 307, Grade A, hot-dip galvanized.
- b. Bolts - ASME B18.2.1.
- c. Nuts - ASME B18.2.2.
- d. Washers

- (1) Plain Washers - ASME B18.22M ASME B18.22.1, Type B.
- (2) Lock Washer - ASME B18.21.1.
- (3) Beveled Washers - ASTM F 436, Beveled.

2.1.4.7 Screws

Screws shall be of the material, grade, type, style, and finish indicated or best suited for use intended.

Cap Screw

ASME B18.2.1, ASME B18.3, or ASME B18.6.2 as required.

Machine Screws

ASME B18.6.3.

2.1.4.8 Welded Shear Studs

ASTM E 32, minimum yield strength of 50 ksi, minimum ultimate strength of 55 ksi.

2.1.4.9 Welding Electrodes

AWS D1.1, E70 Series or as required by AWS Specification.

2.1.4.10 Aluminum

Alloy 6061-T6, 20,000 psi tensile yield strength minimum.

- a. ASTM B 221 and ASTM B 429 for bars, rods, wires, pipes and tubes.

Electrodes for welding aluminum: AWS D1.2, filler alloy 4043 or 5356.

2.1.4.11 Embedded Anchor Bolts, Expansion Anchor Bolts, Adhesive Anchor Bolts

Material: ASTM F 593 Stainless steel, Type 304 or 316. Provide Type 316 unless noted otherwise. Provide minimum edge distance cover and spacing as recommended by manufacturer, or as indicated on Drawings whichever is larger. Depth of embedment: minimum embedment as recommended by manufacturer or nine diameters of bolt, whichever is larger. Notify Contracting Officer if required depth of embedment cannot be achieved at a particular anchor bolt location. Follow manufacturer's recommendations for installation and torque.

Submit manufacturer's load test data to verify at least the anchor bolt

capacities at the following embedment depths: (Data must be based on actual tests performed in unreinforced mass concrete of not more than 4000 psi compressive strength. Capacity must be at a concrete temperature of at least 130 Degrees F).

ANCHOR BOLT EMBEDMENT & CAPACITY

| ANCHOR BOLT DIAMETER | MINIMUM EMBEDMENT (IN) | MINIMUM ULTIMATE TENSION CAPACITY (KIP) |
|-------------------------|---------------------------|--|
| 1/2 | 4-1/2 | 8.1 |
| 5/8 | 5-5/8 | 11.4 |
| 3/4 | 6-3/4 | 15.4 |
| 7/8 | 7-7/8 | 20.1 |
| 1 | 9 | 24.1 |
| 1-1/4 | 11-1/4 | 34.3 |

2.1.4.12 Galvanizing Repair Paint

High zinc dust content paint for regalvanizing welds and abrasions. Dried film shall contain not less than 83 percent zinc dust by weight.

2.1.4.13 Cast Iron Castings

Cast iron castings for stoplog attachment covers and frames shall be as specified for manhole frame and cover in SECTION 02630: STORM-DRAINAGE SYSTEM.

2.1.5 Rubber Seal Pad and Adhesive

Rubber seal material shall be fabricated from material having the same characteristics and material properties as one of the following products. The adhesive used to bond the material to the stoplog shall be as recommended by the manufacturer and as submitted and approved.

- 1) Compound PO-655 as manufactured by Custom Urethane Elastomers, Inc.
- 2) Product 75a as manufactured by Seals Unlimited Inc.
- 3) Keelshield (smooth surface) as manufactured by Wendt Productions Inc.

2.1.6 MANUFACTURED UNITS

2.1.6.1 Steel Grating

ANSI MBG 531. Critical depth, bar thickness and spacing shall be as shown on the Drawings. Cross bars: Welded, swagged or pressure locked to bearing beam, maximum spacing 4 IN/OC. Top edges of bars: Smooth unless shown otherwise on the Drawings. Individual grating sections: not wider than 3 FT. Finish: Hot-dip galvanized. Clips and bolts: Stainless steel or hot-dip galvanized, minimum 4 per grate section. Ends and perimeter edges: No banding required except where shown on the Drawings. Openings through grating: Reinforced to provide required load carrying capacity.

2.1.6.2 Stoplogs

Stoplogs shall be fabricated from aluminum tubes to the dimensions indicated on the drawings. Rubber seals shall be bonded to the stoplogs as indicated on the drawings with an adhesive recommended by the manufacturer of the seal material, and as approved, and suited to the use intended. The padlocks shall also be attached with screws to the stoplogs as indicated on the drawings.

2.1.6.3 Stoplog Tie Down Straps

Two-piece, 2" wide polyester webbed straps with flat hook on each end. Ratchet buckle for tightening. Minimum working load shall be 1000 lb. Minimum length of 20 feet.

2.2 FABRICATION

Provide each fabricated item complete with attachment devices as indicated or required to install.

2.2.1 Structural Fabrication

Structural steel shapes and plate shall be ASTM A36 galvanized, unless noted otherwise on Drawings. Material must be straight before being laid off or worked. If straightening is necessary it shall be done by methods that will not impair the metal. Sharp kinks or bends shall be cause for rejection of the material. Material with welds will not be accepted except where welding is definitely specified, indicated or otherwise approved. Bends shall be made by approved dies, press brakes or bending rolls. Where heating is required, precautions shall be taken to avoid overheating the metal and it shall be allowed to cool in a manner that will not impair the original properties of the metal. Proposed flame cutting of material other than structural steel shall be subject to approval and shall be indicated on detail drawings. Shearing shall be accurate and all portions of the work shall be neatly finished. Corners shall be square and true unless otherwise shown. Re-entrant cuts shall be filleted to a minimum radius of 3/4 inch unless otherwise approved. Finished members shall be free of twists, bends and open joints. Bolts, nuts and screws shall be tight.

2.2.1.1 Dimensional Tolerances for Structural Work

Dimensions shall be measured by an approved calibrated steel tape of approximately the same temperature as the material being measured. The overall dimensions of an assembled structural unit shall be within the tolerances indicated on the drawings or as specified in the particular section of these specifications for the item of work. Where tolerances are not specified in other sections of these specifications or shown, an allowable variation of 1/32 inch is permissible in the overall length of component members with both ends milled and component members without milled ends shall not deviate from the dimensions shown by not more than 1/16 inch for members 30 feet or less in length and by more than 1/8 inch for members over 30 feet in length. Finished members shall be free from

twists, bends and open joints. Sharp kinks, bends and deviation from above tolerances are cause for rejection of material. Comply with requirements of applicable building codes and AISC Specification with modifications and additional requirements specified herein.

2.2.1.2 Structural Steel Fabrication

Structural steel may be cut by mechanically guided or hand-guided torches, provided an accurate profile with a surface that is smooth and free from cracks and notches is obtained. Surfaces and edges to be welded shall be prepared in accordance with AWS D1.1. Where structural steel is not to be welded, chipping or grinding will not be required except as necessary to remove slag and sharp edges of mechanically guided or hand-guided cuts not exposed to view. Hand-guided cuts which are to be exposed or visible shall be chipped, ground or machined to sound metal. Minimize the amount of field welding, shop assemble components into largest size possible commensurate with transportation and handling limitations.

2.2.1.3 Stoplog Grooves and Sill

Extracare shall be taken in the fabrication and installation of the stoplog grooves and sills to ensure that leakage is kept to a minimum. If leakage is excessive and misalignment of the grooves and/or sills, or their component parts, is a contributing factor to the leakage, the Contractor shall propose corrective measures and shall implement corrective measures at no additional cost to the Government. Stoplog groove and end sill surfaces in contact with concrete shall be coated with a bonding agent equal to Sika Armatec 110.

2.2.2 Welding

2.2.2.1 Welding of Structural Steel

a. Welding Procedures for Structural Steel - Welding procedures for structural steel shall be prequalified as described in AWS D1.1, or shall be qualified by tests as prescribed in AWS D1.1. Properly documented evidence of compliance with all requirements of these specifications for previous qualification tests shall establish a welding procedure as prequalified. For welding procedures qualified by tests, the test welding and specimen testing must be witnessed and the test report document signed by the Contracting Officer. Approval of any welding procedure will not relieve the Contractor of the responsibility for producing a finished structure meeting all requirements of these specifications. The Contractor will be directed or authorized to make any changes in previously approved welding procedures that are deemed necessary or desirable by the Contractor Officer. The Contractor shall submit a complete schedule of welding procedures for each steel structure to be welded. The schedule shall conform to the requirements specified in the provisions AWS D1.1. The schedule shall provide detailed procedure specifications and tables or diagrams showing the procedures to be used for each required joint. Welding procedures must include filler metal, preheat, interpass temperature and stress-relief heat treatment requirements. Each welding procedure shall be clearly identified as being prequalified or

required to be qualified by tests. Welding procedures must show types and locations of welds designated or in the specifications to receive nondestructive examination.

b. Welding Process - Welding of structural steel shall be by an electric arc welding process using a method which excludes the atmosphere from the molten metal and shall conform to the applicable provisions of AWS D1.1. Welding shall be such as to minimize residual stresses, distortion and shrinkage. Each welder shall use identifying mark at welds.

c. Welding Technique

(1) Filler Metal - The electrode, electrode-flux combination and grade of weld metal shall conform to the appropriate AWS specification for the base metal and welding process being used or shall be as shown where a specific choice of AWS specification allowables is required. The AWS designation of the electrodes to be used shall be included in the schedule of welding procedures. Only low hydrogen electrodes shall be used for manual shielded metal-arc welding regardless of the thickness of the steel. A controlled temperature storage oven shall be used at the job site as prescribed by AWS D1.1, to maintain low moisture of low hydrogen electrodes.

(2) Preheat and Interpass Temperature - Preheating shall be performed as required by AWS D1.1, or as otherwise specified except that the temperature of the base metal shall be at least 70 degrees F. The weldments to be preheated shall be slowly and uniformly heated by approved means to the prescribed temperature, hold at that temperature until the welding is completed and then permitted to cool slowly in still air. Do not perform welding when ambient temperature is lower than 0 degrees F or where surfaces are wet or exposed to rain, snow, or high wind, or when welders are exposed to inclement conditions.

(3) Stress-Relief Heat Treatment - Where stress relief heat treatment is specified or shown, it shall be in accordance with the requirements of AWS D1.1.

d. Workmanship - Workmanship for welding shall be in accordance with AWS D1.1.

(1) Preparation of Base Metal - Prior to welding the Contractor shall inspect surfaces to be welded to assure compliance with AWS D1.1.

(2) Temporary Welds - Temporary welds required for fabrication and erection shall be made under the controlled conditions prescribed for permanent work. Temporary welds shall be made using low-hydrogen welding electrodes and by welders qualified for permanent work as specified in these specifications. Preheating for temporary welds shall be as required by AWS D1.1 for permanent

welds except that the minimum temperature shall be 120 degrees F in any case. In making temporary welds arcs shall not be struck in other than weld locations. Each temporary weld shall be removed and ground flush with adjacent surfaces after serving its purpose.

(3) Tack Welds - Tacks welds that are to be incorporated into the permanent work shall be subject to the same quality requirements as the permanent welds and shall be cleaned and thoroughly fused with permanent welds. Preheating shall be performed as specified above for temporary welds. Multiple-pass tack welds shall have cascaded ends. Defective tack welds shall be removed before permanent welding.

2.2.2.2 Welding of Aluminum

Welding of aluminum shall conform to AA SAS-30 or AWS D1.2. The welding process and welding operators shall be prequalified as required by AWS D1.2.

A certified report giving the results of the qualifying tests shall be furnished for approval. A complete schedule of the welding process for each aluminum fabrication to be welded shall be furnished for approval.

2.2.3 Bolted Connections

2.2.3.1 Bolted Structural Steel Connections

a. Bolt Holes - Bolt holes shall be accurately located, smooth, perpendicular to the member and cylindrical. Do not make or enlarge holes by burning.

(1) Holes for regular bolts shall be drilled or subdrilled and reamed in the shop and shall not be more than 1/16 inch larger than the diameter of the bolt.

(2) Holes for fitted bolts shall be match-reamed or drilled in the shop. Burrs resulting from reaming shall be removed. The threads of bolts shall be entirely outside of the holes. The body diameter of bolts shall have tolerances as recommended by ASME B4.1 for the class of fit specified. Fitted bolts shall be fitted in reamed holes by selective assembly to provide an LN-2 fit.

(3) Holes for high strength bolts shall have diameters of not more than 1/16 inch larger than bolt diameters. If the thickness of the material is not greater than the diameter of the bolts the holes may be punched. If the thickness of the material is greater than the diameter of the bolts the holes may be drilled full size or subpunched or subdrilled at least 1/8 inch smaller than the diameter of the bolts and then reamed to full size. Poor matching of holes will be cause for rejection. Drifting occurring during assembly shall not distort the metal or enlarge the holes. Reaming to a larger diameter of the next standard size bolt will be allowed for slight mismatching.

2.2.3.2 Bolted Aluminum Connections

Punching, drilling, reaming and bolting for bolted aluminum connections shall conform to the requirements of AA SAS-30, Section 6.

2.2.4 Machine Work

Tolerances, allowances and gauges for metal fits between plain, non-threaded, cylindrical parts shall conform to ASME B4.1 for the class of fit shown or required unless otherwise shown on approved detail drawings. Where fits are not shown they shall be suitable as approved. Tolerances for machine-finished surfaces designated by non-decimal dimensions shall be within 1/64 inch. Sufficient machining stock shall be allowed on placing pads to ensure true surfaces of solid material. Finished contact or bearing surfaces shall be true and exact to secure full contact. Journal surfaces shall be polished and all surfaces shall be finished with sufficient smoothness and accuracy to ensure proper operation when assembled. Parts entering any machine shall be accurately machined and all like parts shall be interchangeable except that parts assembled together for drilling or reaming of holes or machining will not be required to be interchangeable with like parts. All drilled bolt holes shall be accurately located.

2.2.4.1 Unfinished Surfaces

All work shall be laid out to secure proper matching of adjoining unfinished surfaces unless otherwise directed. Where there is a large discrepancy between adjoining unfinished surfaces they shall be chipped and ground smooth or machined to secure proper alignment. Unfinished surfaces shall be true to the lines and dimensions shown and shall be chipped or ground free of all projections and rough spots. Depressions or holes not affecting the strength or usefulness of the parts shall be filled in an approved manner.

2.2.5 Miscellaneous Provisions

2.2.5.1 Metallic Coatings

a. Zinc Coatings - Zinc coatings shall be applied in a manner and of a thickness and quality conforming to ASTM A 123. Where zinc coatings are destroyed by cutting, welding or other causes the affected areas shall be regalvanized. Coatings 2 ounces or heavier shall be regalvanized with a suitable low-melting zinc base alloy similar to the recommendations of the American Hot-Dip Galvanizers Association to the thickness and quality specified for the original zinc coating. Coatings less than 2 ounces shall be repaired in accordance with ASTM A 780.

2.2.6 Shop Assembly

Each machinery and structural unit furnished shall be assembled in the shop to determine the correctness of the fabrication and matching of the component parts unless otherwise specified. Tolerances shall not exceed those shown. Each unit assembled shall be closely checked to ensure that all necessary clearances have been provided and that binding does not occur

in any moving part. Assembly in the shop shall be in the same position as final installation in the field unless otherwise specified. Assembly and disassembly work shall be performed in the presence of the Contracting Officer unless waived in writing. Errors or defects disclosed shall be immediately remedied by the Contractor without cost to the Government. Before disassembly for shipment each piece of a machinery or structural unit shall be match-marked to facilitate erection in the field. The location of match-marks shall be indicated by circling with a ring of white paint after the shop coat of paint has been applied or as otherwise directed.

2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

The Contractor shall have required material tests and analyses performed and certified by an approved laboratory to demonstrate that materials are in conformity with the specifications. These tests and analyses shall be performed and certified at the Contractor's expense. Tests, inspections, and verifications shall conform to the requirements of the particular sections of these specifications for the respective items of work unless otherwise specified or authorized. Tests shall be conducted in the presence of the Contracting Officer if so required. The Contractor shall furnish specimens and samples for additional independent tests and analyses upon request by the Contracting Officer. Specimens and samples shall be properly labeled and prepared for shipment.

2.3.1 Nondestructive Testing

When doubt exists as to the soundness of any material part such part may be subjected to any form of nondestructive testing determined by the Contracting Officer. This may include ultrasonic, magnaflux, dye penetrant, x-ray, gamma ray or any other test that will thoroughly investigate the part in question. The cost of such investigation will be borne by the Government. Any defects will be cause for rejection and rejected parts shall be replaced and retested at the Contractor's expense.

2.3.2 Tests of Machinery and Structural Units

The details for tests of machinery and structural units shall conform to the requirements of the particular sections of these specifications covering these items. Each complete machinery and structural unit shall be assembled and tested in the shop in the presence of the Contracting Officer unless otherwise directed. Waiving of tests will not relieve the Contractor of responsibility for any fault in operation, workmanship or material that occurs before the completion of the contract or guarantee. After being installed at the site each complete machinery or structural unit shall be operated through a sufficient number of complete cycles to demonstrate to the satisfaction of the Contracting Officer that it meets the specified operational requirements in all respects.

2.3.3 Inspection of Structural Steel Welding

The Contractor shall maintain an approved inspection system and perform required inspections in accordance with Contract Clause CONTRACTOR INSPECTION SYSTEM. Welding shall be subject to inspection to determine

conformance with the requirements of AWS D1.1, the approved welding procedures and provisions stated in other sections of these specifications.

Nondestructive examination of designated welds will be required. Supplemental examination of any joint or coupon cut from any location in any joint may be required.

2.3.3.1 Visual Examination

All visual examination of completed welds shall be cleaned and carefully examined for insufficient throat or leg sizes, cracks, undercutting, overlap, excessive convexity or reinforcement and other surface defects to ensure compliance with the requirements of AWS D1.1.

2.3.3.2 Nondestructive Examination

The nondestructive examination of shop and field welds shall be performed as designated or described in the sections of these specifications covering the particular items of work. Ten percent of all welds shall be tested.

a. Testing Agency - The nondestructive examination of welds and the evaluation of examination tests as to the acceptability of the welds shall be performed by a testing agency adequately equipped and competent to perform such services or by the Contractor using suitable equipment and qualified personnel. In either case written approval of the examination procedures is required and the examination tests shall be made in the presence of the Contracting Officer. The evaluation of examination tests shall be subject to the approval and all records shall become the property of the Government.

b. Examination Procedures - Examination procedures shall conform to the following requirements.

(1) Ultrasonic Testing - Making, evaluating and reporting ultrasonic testing of welds shall conform to the requirements of AWS D1.1. The ultrasonic equipment shall be capable of making a permanent record of the test indications. A record shall be made of each weld tested.

(2) Radiographic Testing - Making, evaluating and reporting radiographic testing of welds shall conform to the requirements of AWS D1.1.

(3) Magnetic Particle Inspection - Magnetic particle inspection of welds shall conform to the applicable provisions of ASTM E 709.

(4) Dye Penetrant Inspection - Dye penetrant inspection of welds shall conform to the applicable provisions of ASTM E 165.

c. Acceptability of Welds - Welds shall be unacceptable if shown to have defects prohibited by AWS D1.1, Subsection 9.25 or possess any degree of incomplete fusion, inadequate penetration or undercutting.

2.3.3.3 Test Coupons

The Government reserves the right to require the Contractor to remove coupons from completed work when doubt as to soundness cannot be resolved by nondestructive examination. Should tests of any two coupons cut from the work of any welder show strengths less than that specified for the base metal it will be considered evidence of negligence or incompetence and such welder shall be removed from the work. When coupons are removed from any part of a structure the members cut shall be repaired in a neat manner with joints of the proper type to develop the full strength of the members. Repaired joints shall be peened as approved or directed to relieve residual stress. The expense for removing and testing coupons, repairing cut members and the nondestructive examination of repairs shall be borne by the Government or the Contractor in accordance with the Contract Clauses INSPECTION AND ACCEPTANCE.

2.3.3.4 Supplemental Examination

When the soundness of any weld is suspected of being deficient due to faulty welding or stresses that might occur during shipment or erection the Government reserves the right to perform nondestructive supplemental examinations before final acceptance. The cost of such inspection will be borne by the Government.

2.3.4 Structural Steel Welding Repairs

Defective welds in the structural steel welding repairs shall be repaired in accordance with AWS D1.1. Defective weld metal shall be removed to sound metal by use of air carbon-arc or oxygen gouging. The surfaces shall be thoroughly cleaned before welding. Welds that have been repaired shall be retested by the same methods used in the original inspection. Except for the repair of members cut to remove test coupons and found to have acceptable welds costs of repairs and retesting shall be borne by the Contractor.

PART 3 EXECUTION

3.1 INSTALLATION

All parts to be installed shall be thoroughly cleaned. Packing compounds, rust, dirt, grit and other foreign matter shall be removed. Holes and grooves for lubrication shall be cleaned. Where units or items are shipped as assemblies they will be inspected prior to installation. Disassembly, cleaning and lubrication will not be required except where necessary to place the assembly in a clean and properly lubricated condition. Pipe wrenches, cold chisels or other tools likely to cause damage to the surfaces of rods, nuts or other parts shall not be used for assembling and tightening parts. Bolts and screws shall be tightened firmly and uniformly but care shall be taken not to overstress the threads. When a half nut is used for locking a full nut the half nut shall be placed first and followed by the full nut. Threads of all bolts except high strength bolts, nuts and screws shall be lubricated with an approved lubricant before assembly. Threads of corrosion-resisting steel bolts and nuts shall be coated with an approved antigalling compound. Driving and drifting bolts or keys will not be permitted. After erection, grind smooth all sharp surface

irregularities resulting from field cutting or welding; power tool clean welds, bolts, washers and abrasions to shop coat removing all rust and foreign matter.

3.1.1 Alignment and Setting

Each machinery or structural unit shall be accurately aligned by the use of steel shims or other approved methods so that no binding in any moving parts or distortion of any member occurs before it is fastened in place. The alignment of all parts with respect to each other shall be true within the respective tolerances required. Machines shall be set true to the elevations shown.

3.1.2 Blocking and Wedges

All blocking and wedges used during installation for the support of parts to be grouted in foundations shall be removed before final grouting unless otherwise directed. Blocking and wedges left in the foundations with approval shall be of steel or iron.

3.1.3 Expansion Anchor Bolts and Adhesive Anchor Bolts

Install in strict accordance with manufacturer's instructions for hole size, hole cleaning, installation, torque requirements substrate temperature and curing. Use only carbide-tipped drilling equipment.

3.1.4 Bolted Connections

Install ASTM A 325 bolts with hardened washers. Install and tighten in accordance with Section 8 of Specifications for Structural Joints. Coordinate installation with inspection. Do not start installation until coordination with Testing Agency is complete. Slip critical connections: Perform calibration testing for all methods of installation of high-strength bolts in accordance with Section 8(b) of Specification for Structural Joints, using ASTM A 325 bolts.

1. Turn-of-nut tightening: Torque wrenches shall be used only by laboratory personnel.
2. Calibrated wrench tightening: Calibrate on a daily basis.
3. Direct tension indicator tightening: If previously approved by Contracting Officer.
4. Installation of alternate design bolts: If previously approved by Contracting Officer.

In the event any bolt in a connection is found to be defective, check and retighten all bolts in the connection.

Do not use gas cutting to correct fabrication errors. In case members do not fit or holes do not match, ream out the holes and insert the next larger size bolt. If the connections require new holes, then drill new holes. Make no such corrections without prior approval of the Contracting

Officer. Burning of holes: Not permitted.

Tighten and leave in place erection bolts used in welded construction. Provide beveled washers to give full bearing to bolt head or nut where bolts are to be used on surfaces having slopes greater than 1 in 20 with a plane normal to bolt axis.

After bolts are tightened, upset threads of A 307 unfinished bolts and anchor bolts to prevent nuts from backing off.

3.1.5 Steel Grating

Attach grating to end and intermediate supports with grating saddle clips and bolts. Maximum spacing: at 2 Feet on-centers with a minimum of two per side. Attach individual units of grating together with clips at 2 feet on centers maximum with a minimum of two clips per side.

3.2 PROTECTION OF FINISHED WORK

3.2.1 Machined Surfaces

Machined surfaces shall be thoroughly cleaned of foreign matter. All finished surfaces shall be protected by suitable means. Unassembled pins and bolts shall be oiled and wrapped with moisture resistant paper or protected by other approved means. Finished surfaces of ferrous metals to be in bolted contact shall be washed with an approved rust inhibitor and coated with an approved rust resisting compound for temporary protection during fabrication, shipping and storage periods. Finished surfaces of metals which shall be exposed after installation except galvanized steel or nonferrous metals shall be painted as specified in SECTION 09900: PAINTING, GENERAL.

3.2.2 Galvanized Surfaces

Repair damaged galvanized surfaces in accordance with ASTM A 780. Prepare damaged surfaces by abrasive blasting or power sanding. Apply galvanizing repair paint in accordance with manufacturer's instructions. Minimum thickness: larger of 6 mils DFT or manufacturer's standard.

3.3 TESTS

3.3.1 Workmanship

Workmanship shall be of the highest grade and in accordance with the best modern practices to conform with the specifications for the item of work being furnished.

3.3.2 Production Welding

Production welding shall conform to the requirements of AWS D1.1 or AWS D1.2 as applicable.

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SECTION 05300

STEEL DECKING

04/01

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 ASD Spec (1989) Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mnl (1996) Cold-Formed Steel Design Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 108 (1995) Steel Bars, Carbon, Cold Finished, Standard Quality

ASTM A 570/A 570M (1996) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM A 611 (1997) Structural Steel (SS), Sheet, Carbon, Cold-Rolled

ASTM A 653/A 653M (1997) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 780 (1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings

ASTM A 792/A 792M (1997) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM C 423 (1990a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM E 795 (1993) Mounting Test Specimens During Sound Absorption Tests

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (1998) Structural Welding Code - Steel
AWS D1.3 (1998) Structural Welding Code - Sheet Steel

STEEL DECK INSTITUTE (SDI)

SDI Diaphragm Mnl (1987; Amended 1991) Diaphragm Design Manual
SDI Pub No 29 (1995) Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 20 (1991) Zinc-Rich Primers (Type I - Inorganic and Type II - Organic)

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "GA" designation are for information only. The following shall be submitted in accordance with Section 01330 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; FIO. Accessories; FIO.

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and supporting members; 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 29. Panels of maximum possible lengths shall be used to minimize end laps. Deck units shall be fabricated in lengths to span 3 or more supports with flush, telescoped, or nested 2 inchlaps 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 Cold-Formed Mnl, 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 shall conform to ASTM A 792/A 792M, ASTM A 611 or ASTM A 792/A 792M. Roof deck units shall be fabricated of the steel design thickness required by the design drawings and shall be galvanized.

2.2 TOUCH-UP PAINT

Touch-up paint for zinc-coated units shall be an approved galvanizing repair paint with a high-zinc dust content. Welds shall be touched-up with paint conforming to SSPC Paint 20 in accordance with ASTM A 780. Finish of deck units and accessories shall be maintained by using touch-up paint whenever necessary to prevent the formation of rust.

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.

2.4.2 Cover Plates to Close Panels

Cover plates to close panel edge and end conditions and where panels change direction or abut. Butt joints in composite steel deck may receive a tape

joint cover.

2.4.3 Sheet Metal

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.5 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, 0.0474 inch; welding washers, 0.0598 inch; cant strip, 0.0295 inch; other metal accessories, 0.0358 inch; unless otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

PART 3 EXECUTION

3.1 ERECTION

Erection of deck and accessories shall be in accordance with SDI Pub No 29 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 filled with concrete, 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 ATTACHMENTS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be welded with nominal 5/8 inch diameter puddle welds or fastened with screws, powder-actuated fasteners or pneumatically driven fasteners to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No 29. All welding of steel deck shall be in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the steel deck being used. Welds shall be made only by operators previously qualified by tests prescribed in AWS D1.3 to perform the type of work required. Welding washers shall not be used at the connections of the deck to supports. Welding washers shall not be used at sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped 2 inches. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI Diaphragm Mnl. Powder-actuated fasteners shall be driven with a low-velocity piston tool by an operator authorized by the manufacturer of the piston tool. Pneumatically driven fasteners shall be driven with a low-velocity fastening tool and shall comply with the manufacturer's

recommendations.

3.3 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings, specifications, and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 6 inches across require no reinforcement. Holes and openings 6 to 12 inches across shall be reinforced by 0.0474 inch thick steel sheet at least 12 inches wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inches on center. Holes and openings larger than 12 inches shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.

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SECTION 05420

COLD-FORMED METAL JOIST AND TRUSSES

04/01

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 MATERIAL (ASTM)

ASTM A 653 (1994) Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot Dip Process.

ASTM A 780 (1993a) Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI (1990) Specifications for the Design of Cold-Formed Steel Structural Members.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 Structural Welding Code - Steel.

AWS D1.3 Structural Welding Code - Sheet Steel.

1.2 SUBMITTALS

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

SD-01 Data

Submit Manufacturers' Product Data and installation instructions for each type of cold-formed steel framing and accessory required.

SD-04 Drawings

Roof Trusses; GA.

Show member, type, location, spacing size and gage of members, method of

attachment to supporting members and all necessary erection details. Indicate supplemental bracing, strapping, splices, bridging, accessories and details required for proper installation.

Submit detailed roof truss layouts.

Truss Drawings: Sealed and signed by a qualified registered Engineer, verifying truss ability to meet local code and design requirements, including:

- a. Description of design criteria.
- b. Engineering analysis depicting member stresses and truss deflection.
- c. Truss member sizes and gages and connections at truss joints.
- d. Truss support reactions.
- e. Top chord, bottom chord and web bracing requirements.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Structural Characteristics

Calculate structural characteristics of cold-formed steel truss members according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members".

1.3.2 Structural Performance

Design, engineer, fabricate, and erect cold-formed steel trusses to withstand specified design loads within limits and under conditions required.

- a. Design loads: Snow Load of 50 psf .
- b. Vertical live-load deflections for roof trusses shall be less than or equal to 1/240 of the span.
- c. Design framing systems to provide for movement of framing members without damage or over-stressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 120 F degrees.

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Fabricator: Shall be an experienced cold-formed steel truss fabricator with not less than 3 satisfactory experiences designing and fabricating cold-formed steel truss systems equal in material, design and extent to the systems required for this Project.

Installer: Cold-formed steel truss system installation shall be performed by an experienced installer approved by the steel truss system fabricator.

Welder: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure.

1.5 DELIVERY, STORAGE AND HANDLING

1.5.1 Protection

Protect trusses and accessories from corrosion, deformation, damage and deterioration when stored at job site. Keep trusses free of dirt and other foreign matter.

1.5.2 Delivery

Deliver materials in manufacturers' unopened containers or bundles, fully identified by name, brand, type and grade. Exercise care to avoid damage during unloading, storing and erection.

1.5.3 Storage

Store trusses on blocking, pallets, platforms or other supports off the ground and in an upright position sufficiently braced to avoid damage from excessive bending.

1.5.4 Damaged Material

Replace damaged material prior to acceptance at no additional cost to the Owner.

1.6 PROJECT CONDITIONS

1.6.1 Existing Conditions

Inspect the project prior to installation. If conditions do not meet approval, notify the Architect. Proceeding without notification implies acceptance of conditions.

1.6.2 Field Measurements

Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication. Show recorded measurements on final Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work. Where field measurements cannot be made without delaying Work, guarantee dimensions and proceed with fabrication without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

1.6.3 Load Distribution

During construction, adequately distribute all loads applied to trusses so as not to exceed the carrying capacity of any one joist, truss or other component.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Design Standard of Quality is based on Tru-Tek, 27725 Danville Avenue, PO Box 458, Castle Rock, MN 55010, (651) 463-7009, Fax: (651) 463-2479.

2.2 COMPONENTS

System components Standard of Quality are based on MiTek Industries, Inc., ULTRA-SPAN and POSI-STRUT light-gage steel floor truss and roof truss components.

2.3 MATERIALS

2.3.1 General

Provide manufacturers' standard steel truss members, bracing, bridging, blocking, reinforcements, fasteners and accessories with each type of steel framing required, as recommended by the manufacturer for the applications indicated and as needed to provide a complete light-gage cold-formed steel truss system.

Component Gages: Fabricate components of structural quality steel sheet per ASTM A 653, with a minimum yield strength of 40,000 psi.

Bracing, bridging and blocking members: Fabricate components of commercial quality steel sheet per ASTM A 653 with a minimum yield strength of 33,000 psi.

2.3.2 Ultra-Span Steel Truss Components

Provide sizes, shapes and gages as shown on drawings and as indicated below:

- a. Design uncoated steel thickness: 20 gage, 0.0360 inch.
- b. Design uncoated steel thickness: 18 gage, 0.0470 inch.
- c. Design uncoated steel thickness: 16 gage, 0.0580 inch.
- d. Design uncoated steel thickness: 14 gage 0.0750 inch.

2.3.3 Finish

Provide components with protective zinc coating, complying with ASTM A 653, minimum G60 coating.

2.3.4 Fastenings

Manufacturer-recommended self-drilling, self-tapping screws with

corrosion-resistant plated finish. Fasteners shall be of sufficient size and number to ensure the strength of the connection.

Welding: Comply with AWS D1.1 when applicable and AWS D1.3 for welding base metals less than 1/8-inch thick.

Other fasteners as accepted by truss-design engineer

2.4 FABRICATION

Factory-fabricate cold-formed steel trusses plumb, square, true to line, and with connections securely fastened, according to manufacturers' recommendations and the requirements of the Section.

Fabricate truss assemblies in jig templates.

Fasten cold-formed steel truss members by welding or screw fastening or other methods as standard with fabricator. Wire tying of framing members is not permitted.

Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

Locate mechanical fasteners and install according to cold-framed steel truss component manufacturers' instructions with screw penetrating joined members by not less than 3 exposed screw threads.

Care shall be taken during handling, delivery and erection. Brace, block, or reinforce truss as necessary to minimize member and connection stresses.

Fabricate trusses to a maximum allowable tolerance variation from plumb, level, and true-to-line of 1/8 inch in 10 feet (1:960).

Fabricate each cold-formed steel truss to a maximum out-of-square tolerance of 1/8 inch.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Work of Other Trades

Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.

3.1.2 Verification of Conditions

Verify that trusses may be installed in accordance with original design, pertinent codes and regulations, and pertinent portions of referenced standards.

3.1.3 Discrepancies

Immediately notify the Contracting Officer's Representative. Do not proceed

with installation in areas of discrepancy until fully resolved.

3.1.4 Conditions

Examine structure, substrates and installation conditions. Do not proceed with cold-formed steel truss installation until unsatisfactory conditions have been corrected.

Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.2 INSTALLATION

Erection of trusses, including proper handling, safety precautions, temporary bracing, and other safeguards or procedures are the responsibility of the Contractor and the Contractor's installer.

Exercise care and provide erection bracing required to prevent toppling or dominoing of trusses during erection.

Follow OSHA requirements.

Erect trusses with plane of truss webs vertical and parallel to each other, accurately located at design spacing indicated.

Provide proper lifting equipment suited to sizes and types of trusses required, applied at lift points recommended by truss fabricator. Exercise care to avoid damage to truss members during erection and to keep horizontal bending of the trusses to a minimum.

Provide framing anchors as indicated or accepted on the design drawings or erection drawings. Anchor trusses securely at bearing points.

Install roof framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturers' recommendations.

DO NOT cut truss members without prior approval of Government.

Fasten cold-formed steel roof framing by welding or screw fastening, as standard with fabricator. Wire tying of roof framing is not permitted.

Comply with AWS requirements and procedures for welding appearance and quality of welds, and methods used in correcting welding work.

Locate mechanical fasteners and install according to cold-formed roof framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

Install roof framing in one-piece lengths, unless splice connections are indicated.

Provide temporary bracing and leave in place until trusses are permanently stabilized.

Install trusses to a maximum allowable tolerance variation from plumb, level, and true-to-line of 1/8 inch in 10 feet (1:960).

Space individual trusses no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 TRUSS INSTALLATION

Space trusses 24 inches on centers.

Do not alter, cut, or remove truss members or connections of trusses.

Erect trusses with plane of truss webs plumb and parallel to each other, align and accurately position at spacing indicated.

Effect trusses without damaging truss members or connections.

Align truss bottom chords with load-bearing studs or continuously reinforce tract to transfer loads to structure. Anchor trusses securely at all bearing points.

Install continuous bridging and permanent truss bracing per truss design requirements.

Install necessary roof cross and diagonal per design professional recommendations.

3.4 REPAIRS AND PROTECTION

Prepare and repair damaged galvanized coatings on fabricated and install cold-formed steel framing with galvanizing repair paint according to ASTM A 780 and the manufacturers' instructions.

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SECTION 05500

MISCELLANEOUS METAL

04/01

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SECTION 05500

MISCELLANEOUS METAL
04/01

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 DAF-45 (1980; R1993) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3 (1992) Ladders - Fixed - Safety Requirements

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36 (1996) Carbon Structural Steel

ASTM A 53 (1996) 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 500 (1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A 569 (1997) Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality

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

ASTM A 924 (1996a) Steel Sheet, Metallic-Coated by the Hot-Dip Process

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (1995) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

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

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-344 (Rev. B) Lacquer, Clear Gloss, Exterior,
Interior

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531 (1993) Metal Bar Grating Manual

NAAMM MBG 532 (1988) Heavy Duty Metal Bar Grating Manual

1.2 SUBMITTALS

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

SD-04 Drawings

Miscellaneous Metal Items; GA.

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

1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123, ASTM A 653, or ASTM A 924, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive

materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint or asphalt varnish.

1.5 WORKMANSHIP

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

1.6 ANCHORAGE

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

1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have standard mill finish. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Items to be anodized shall receive a polished satin finish. Aluminum surfaces to be in contact with plaster or concrete during construction shall be protected with a field coat conforming to CID A-A-344.

1.8 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.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS

Doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 16 gauge steel with welded joints and finished with anchorage for securing into construction. Access doors shall be a minimum of 14 by 20 inches and of

not lighter than 14 gauge steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame and provided with a flush face, screw driver operated latch. Exposed metal surfaces shall have a baked enamel finish.

2.2 ACCESS HATCHES AND COVERS

Hatch(s) shall be a single leaf type pre-assembled by the manufacturer. Frames for the access hatch shall be fabricated from ¼" thick aluminum channel and furnished with bend down anchor tabs for securing into poured concrete construction. The frame shall include a perimeter gasket around the cover edge surface to minimize dirt and debris from entering the channel frame. The frame shall include a drain coupling; location as approved by the Contracting Officer's Representative. Access covers shall be a minimum of 30" by 36" inches in size and ¼" thick aluminum plate with hinges mounted on the long side (opening hand approved by the Contracting Officer's Representative). Hinges shall be of forged aluminum and bolted to the cover and frame using 316 S.S. fasteners with flush heads on the cover. Hinges shall utilize 316 S.S. or other corrosion resistant material for the hinge pins. Covers shall be able to support a 300 psf (pound per square foot) load with a maximum of 1/150th of the span for deflection. Access covers shall be hinged to the frame and provided and smooth and easy controlled operation through the operating arc and such operation is unaffected by ambient temperatures. The cover shall be assisted in opening by enclosed compression spring operator springs, which also prevent uncontrolled slamming of the cover in the closing mode. A spring-operated latch shall secure the cover in the closed position and operated by a removable handle with a spring-loaded detent to hold the handle in place. The handle hole shall be sealed in non-use periods by a gasketed flush head removable screw plug. Covers shall be equipped with a safety hold open device to secure the open position at 90 degrees. Exposed metal surfaces shall have a factory finish of mill aluminum, with the frame exterior surface coated with bituminous material for concrete contact. The access hatch(s) shall be similar or equal to Bilco Model JD-AL as manufactured by Bilco Company, New Haven, Connecticut.

2.3 LADDER SAFETY DEVICES

Rails, travel sleeve, and safety belt shall be Saf-T-Lok components as manufactured by North Safety Products, Cranston, R.I. 02921, or equal.

2.4 PIPE GUARDS

Pipe guards shall be heavy duty steel pipe conforming to ASTM A 53, Type E or S, weight STD, black finish.

2.5 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, frames, and steel door frames shall be provided to complete the work. All miscellaneous plates and shapes shall be hot-dipped galvanized in accordance with Section 05055: METALWORK FABRICATION, MACHINE WORK, MISCELLANEOUS PROVISIONS.

2.6 STEEL DOOR FRAMES (Overhead Coiling Door)

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 2 by 1/4 by 12 inch bent, adjustable metal anchors spaced not over 24 inches on centers. Provision shall be made to stiffen the top member for all spans over 3 feet..

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

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

3.2 REMOVABLE ACCESS PANELS

A removable access panel not less than 12 by 12 inches shall be installed directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

3.3 INSTALLATION OF 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 3000 psi..

3.4 LADDER SAFETY DEVICES

Each ladder shall be provided with a center rail bolted to the center of the ladder with mounting brackets not less than 5 feet apart that secure the rail to the ladder rungs. The rail shall be fabricated of galvanized steel pipe with notches every 6 inches to engage a pawl on the actuation sleeve that follows the pipe. The sleeve shall have a safety snap secured to the body of the sleeve in such a manner that springs and pins will engage the locking pawl should uncontrolled descent begin. Upward travel over the guide rail is unrestricted and allows free ascent. A 36" section of rail shall be fabricated to extend above the hatch cover surface in the open condition. This section shall be secured to the main ladder rail by a rod inside the 36" section that engages a threaded insert at the end of the ladder rail. In addition the 36" section shall have the end formed to engage an enlarged bell on the top of the ladder rail. This shall provide positive locking of the rail extension into the ladder rail. A safety belt of nylon fabric webbing with necessary drop forged rings to secure to the sleeve shall be furnished in an adjustable design for the person's waist.

The Contractor shall provide a belt for each pump station and all ladders in the pump stations and gatewells shall be provided with the specified rail system over the entire length of the ladder. All ladder locations that terminate at the top level of the gatewell or pump station shall be

provided with the specified removable rail extensions. Ladders that terminate at an intermediate landing in the gatewell shall have the rail extend 36" above the grating.

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SECTION 06100

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SECTION 06100

ROUGH CARPENTRY

04/01

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 & PAPER ASSOCIATION (AF&PA)

AF&PA T01 (1991; Supplement 1993; Addenda Apr 1997; Supple T02) National Design Specification for Wood Construction

AF&PA T11 (1988) Manual for Wood Frame Construction

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4 (1995) Basic Hardboard

AHA A194.1 (1985) Cellulosic Fiber Board

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

AITC TC Manual (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 190.1 (1992) Wood Products - Structural Glued Laminated Timber

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1 (1999) Particleboard Mat Formed Woods

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 307 (1997) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

| | |
|---------------------|--|
| ASTM C 79/C 79M | (1997) Treated Core and Nontreated Core Gypsum Sheathing Board |
| ASTM C 208 | (1995) Cellulosic Fiber Insulating Board |
| ASTM C 516 | (1980; R 1996e1) Vermiculite Loose Fill Thermal Insulation |
| ASTM C 518 | (1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Heat Flow Meter Apparatus |
| ASTM C 549 | (1981; R 1995e1) 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 | (1995) Rigid, Cellular Polystyrene Thermal Insulation |
| ASTM C 591 | (1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation |
| ASTM C 612 | (1993) Mineral Fiber Block and Board Thermal Insulation |
| ASTM C 665 | (1998) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing |
| ASTM C 726 | (1993) Mineral Fiber Roof Insulation Board |
| ASTM C 739 | (1997) Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation |
| ASTM C 764 | (1998) Mineral Fiber Loose-Fill Thermal Insulation |
| ASTM C 1136 | (1995) Flexible, Low Permeance Vapor Retarders for Thermal Insulation |
| ASTM C 1177/C 1177M | (1996) Glass Mat Gypsum Substrate for Use as Sheathing |
| ASTM C 1289 | (1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board |
| ASTM D 2898 | (1999) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing |

| | |
|-------------|--|
| ASTM D 3498 | (1999) Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems |
| ASTM E 84 | (1999) Surface Burning Characteristics of Building Materials |
| ASTM E 96 | (1995) Water Vapor Transmission of Materials |
| ASTM E 154 | (1988; R 1999) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover |
| ASTM F 547 | (1977; R 1995) 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 | (1997) Plywood - Preservative Treatment by Pressure Processes |
| AWPA C20 | (1996) Structural Lumber Fire-Retardant Pressure Treatment |
| AWPA C27 | (1996) Plywood - Fire-Retardant Pressure Treatment |
| AWPA M4 | (1996) Standard for the Care of Preservative-Treated Wood Products |
| AWPA P5 | (1997) Standards for Waterborne Preservatives |

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

| | |
|---------------|---|
| APA EWS R540C | (1996) Builder Tips Proper Storage and Handling of Glulam Beams |
| APA EWS T300C | (1997) Technical Note Glulam Connection Details |
| APA PRP-108 | (1980; Rev Jan 1996) Performance Standards and Policies for Structural-Use Panels |

CALIFORNIA REDWOOD ASSOCIATION (CRA)

| | |
|---------------|---|
| CRA RIS-01-SS | (1997) Standard Specifications for Grades |
|---------------|---|

of California Redwood Lumber

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1209 Interim Safety Standard for Cellulose
Insulation

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard -
Construction and Industrial Plywood

DOC PS 2 (1992) Performance Standards for
Wood-Based Structural-Use Panels

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM LPD 1-49 (1995) Loss Prevention Data Sheet -
Perimeter Flashing

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules (1994) Rules for the Measurement &
Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules (1997) Standard Grading Rules for
Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Specs (1986; Supple No. 1, Aug 1993) Standard
Specifications for Grades of Southern
Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB Rules (1994; Supple 8 thru 11) Standard Grading
Rules for Southern Pine Lumber

TRUSS PLATE INSTITUTE (TPI)

TPI 1 (1995; Errata) National Design Standard
for Metal Plate-Connected Wood Truss
Construction and Commentary; and Appendix 1

TPI Bklet HIB (1991) Handling, Installing & Bracing
Metal Plate Connected Wood Trusses

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1996; Supples VII(A-E), VIII(A-C))
Grading Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA Grading Rules

(1999) Western Lumber Grading Rules 95

1.2 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity. Laminated timber shall be handled and stored in accordance with AITC 111 or APA EWS R540C.

PART 2 PRODUCTS

2.1 LUMBER, TIMBER, AND SHEATHING

2.1.1 Grading and Marking

2.1.1.1 Lumber Products

Solidsawn and finger-jointed lumber and timber 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 Plywood and Other Sheathing Products

Materials shall bear the grademark or other identifying marks indicating grades of material and rules or standards under which produced, including requirements for qualifications and authority of the inspection organization. Except for plywood and wood structural panels, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

2.1.2 Sizes

Lumber, timber, and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber and timber shall be surfaced on four sides. Unless otherwise specified, sizes indicated are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

2.1.3 Treatment

Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWWA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil. Except as specified for all-heart material of the previously mentioned species, the following items shall be treated:

- a. Wood members in contact with or within 18 inches of soil.
- b. Wood members in contact with water.
- c. Wood members exposed to the weather including those used in builtup 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. 0.25 pcf intended for above ground use.
- b. 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. 0.25 pcf intended for above ground use.
- b. 0.40 pcf intended for ground contact and fresh water use.

2.1.4 Moisture Content

At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

- a. Treated and Untreated Lumber Except Roof Planking: 4 inches or less, nominal thickness, 19 percent maximum. 5 inches or more, nominal thickness, 23 percent maximum in a 3 inch perimeter of the timber cross-section.
- b. Roof Planking: 15 percent maximum.
- c. Materials Other Than Lumber: In accordance with standard under which product is produced.

2.1.5 Sheathing

2.1.5.1 Plywood

Plywood shall conform to DOC PS 1, APA PRP-108 or DOC PS 2, Grade C-D or sheathing grade with exterior glue. Sheathing for roof and walls without

corner bracing of framing shall have a span rating of 16/0 or greater for supports 16 inches on center and a span rating of 24/0 or greater for supports 24 inches on center.

2.1.6 Miscellaneous Wood Members

2.1.6.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

| Member | Size (inch) |
|----------------|--|
| Bridging | 1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12. |
| Corner bracing | 1 x 4. |
| Furring | 1 x 2. |
| Grounds | Plaster thickness by 1-1/2. |
| Nailing strips | 1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock. |

2.1.6.2 Sill Plates

Sill plates shall be standard or number 2 grade.

2.1.6.3 Blocking

Blocking shall be standard or number 2 grade.

2.1.6.4 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, 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 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 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails shall be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AF&PA T11. 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 AF&PA T01. Reasonable judgement backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

2.3 INSULATION

2.3.1 Sill Sealer

Mineral wool, 1 inch thick and compressible to 1/32 inch, width of sill, designed to perform as an air, dirt, and insect seal in conformance with ASTM C 665, Type I.

PART 3 EXECUTION

3.1 INSTALLATION OF FRAMING

3.1.1 General

General framing shall be in accordance with AF&PA T11. 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 AF&PA T01 for the passage of pipes, wires, or conduits. Rafters, purlins, and joists shall be set with crown edge up. Framing shall be kept at least 2 inches away from chimneys and 4 inches away from fireplace backwalls. When joists, beams, and girders are placed on masonry or concrete, a wood base plate shall be positioned and leveled with grout. The joist, beam, or girder shall then be placed on the plate. When joists, beams, and girders are set into masonry or concrete, a pocket shall be formed into the wall. The joist, beam, or girder shall then be placed into

the pocket and leveled with a steel shim.

3.1.2 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 16 inches on centers. Stud shall be doubled at openings. Unless otherwise indicated, headers for openings shall be made of two pieces of stud material set on edge or solid lumber of equivalent size, and corners shall be constructed of not less than three full members. End studs of partitions abutting concrete or masonry shall be anchored thereto with expansion bolts, one near each end of each stud and at intermediate intervals of not more than 4 feet. Plates of partitions resting on concrete floors shall be anchored in place with expansion bolts, one near each end of each piece and at intermediate intervals of not more than 6 feet between bolts. In lieu of expansion bolts, anchoring into concrete may be accomplished with powder-driven threaded studs of suitable type and size and spaced at 3 feet on center. Walls and load bearing partitions shall be provided with double top plates with members lapped at least 2 feet and well spiked together.

3.2 INSTALLATION OF SHEATHING

3.2.1 Plywood and Wood Structural Panels

Sheathing shall be applied with edges 1/8 inch apart at side and end joints, and nailed at supported edges at 6 inches on center and at intermediate supports 12 inches on center unless otherwise shown. Nailing of edges shall be 3/8 inch from the edges. Wall sheathing shall extend over top and bottom plates, and if applied horizontally the vertical joints shall be made over supports and staggered. Wall sheathing over which wood shingles are to be applied shall be applied horizontally. Roof sheathing shall be applied with long dimension at right angles to supports, end joints made over supports, and end joints staggered.

3.3 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

3.3.1 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.

3.3.2 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.

3.3.3 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 8 feet for any concealed space. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

3.3.4 Nailers and Nailing Strips

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Nailers used in conjunction with roof deck installation shall be installed flush with the roof deck system. Stacked nailers shall be assembled with spikes or nails spaced not more than 18 inches on center and staggered. Beginning and ending nails shall not be more than 6 inches for nailer end. Ends of stacked nailers shall be offset approximately 12 inches in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members when necessary, and rigidly secured in place. Nailers and nailer installation for Factory Mutual wind uplift rated roof systems specified in other Sections of these specifications shall conform to the recommendations contained in FM LPD 1-49.

3.3.5 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.

3.3.6 Rough Bucks and Frames

Rough bucks shall be set straight, true, and plumb, and secured with anchors near top and bottom of each wood member and at intermediate intervals of not more than 3 feet. Anchors for concrete shall be expansion bolts, and anchors for masonry shall be 3/16 x 1-1/4 inch steel straps extending not less than 8 inches into the masonry and turned down 2 inches into the masonry.

3.3.7 Sill Plates

Sill plates shall be set level and square and anchor bolted at not more than 4 feet on centers and not more than 12 inches from end of each piece. A minimum of two anchors shall be used for each piece.

3.4 INSTALLATION OF TIMBER CONNECTORS

Installation of timber connectors shall conform to applicable requirements

of AF&PA T01.

3.5 TABLES

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 Rules | Cypress | | | X | |
| NELMA Grading Rules | 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 Specs | Cypress | | | X | |
| SPIB Rules | Southern Pine | | X | | |
| WCLIB Std 17 | Douglas Fir-Larch | X | | | |
| | Hem-Fir | X | | | |
| | Sitka Spruce | X | | | |
| | Mountain Hemlock | X | | | |
| | Western Cedar | X | | | |
| WWPA Grading Rules | 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 Rules | Red Oak | X | |
| NELMA Grading Rules | Northern Pine | | X |
| | Eastern Hemlock- Tamarack | | X |
| SPIB Rules | Southern Pine | X | |
| WCLIB Std 17 | Douglas Fir-Larch | | X |
| | Hem-Fir | | X |
| WWPA Grading Rules | Douglas Fir-Larch | | X |
| | Hem-Fir | | X |
| | Douglas Fir-South | | X |

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DIVISION 06 - WOODS & PLASTICS

SECTION 06190

PREFABRICATED WOOD TRUSSES

04/01

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PART 2 PRODUCTS

- 2.1 ROOF TRUSSES
 - 2.1.1 Truss Design Loads
- 2.2 BRIDGING
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 - 2.3.1 Securing Trusses
 - 2.3.2 Truss Connectors

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 General

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SECTION 06190

PREFABRICATED WOOD TRUSSES

04/01

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.

UNIFORM BUILDING CODE (UBC)

UBC (1997)Uniform Building Code

1.2 SUBMITTALS

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

SD-01 Data

Design Calculations; GA.

Submit manufacturer's design calculations prepared and sealed by a registered professional engineer.

SD-04 Shop Drawings

Pre-engineered, shop-assembled wood roof trusses; GA.

Shop drawings shall include layout drawing indicating location and spacing; dimensions and size of members; connection details; allowable material stresses, wind loads, live loads, and dead loads; camber and allowable deflection; bridging size and spacing; and truss connectors.

PART 2 PRODUCTS

2.1 ROOF TRUSSES

Trusses fabricated from stress-graded wood chord and web members as shown.

2.1.1 Truss Design Loads

Trusses shall support a live load of 50 psf and wind load of 20 psf. Determine and support weight of sub-roof, ceiling, and other dead loads.

Trusses shall be cambered twice dead load or as recommended by manufacturer. Deflection shall not exceed 1/240 of span.

2.2 BRIDGING

Provide wood diagonal and straight bridging as required to develop full load capabilities of trusses.

2.3 ACCESSORIES

2.3.1 Securing Trusses

Provide anchors, plates, bolts, shear devices, outriggers, and appurtenances to secure trusses to structure.

2.3.2 Truss Connectors

Provide 16 ga. galvanized truss connectors to attach trusses to top plate of wall; Simpson TC Truss Connectors, or equal.

PART 3 EXECUTION

3.1 INSTALLATION

Install trusses and accessories in accordance with shop drawings and manufacturer's instructions.

3.1.1 General

Provide temporary bracing or false work to maintain safety and structural integrity of members until assembly is in place and final connections are made. Straighten trusses by nailing temporary spacers to top and bottom chords before application of decking. Comply with manufacturer's recommendations for bridging and connections.

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SECTION 06200

FINISH CARPENTRY

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SECTION 06200

FINISH CARPENTRY

04/01

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 A208.1 (1999) Particleboard Mat Forms Woods
ANSI Z124.3 (1995) Plastic Lavatories
ANSI Z124.6 (1995) Plastic Sinks

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM F 547 (1977; R 1995) Definitions of Terms
Relating to Nails for Use with Wood and
Wood-Base Materials

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C9 (1997) Plywood - Preservative Treatment by
Pressure Processes
AWPA M4 (1996) Standard for the Care of
Preservative-Treated Wood Products
AWPA P5 (1997) Standards for Waterborne
Preservatives

CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA RIS-01-SS (1997) Standard Specifications for Grades
of California Redwood Lumber

DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard -
Construction and Industrial Plywood

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

NIST PS 20 (1994; Addenda Jan. 1997) American

Softwood Lumber Standards

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules (1997) Standard Grading Rules for Northeastern Lumber

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Specs (1986; Supple No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB Rules (1994;Supple 8 thru 11) Standard Grading Rules for Southern Pine Lumber

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1996; Supples VII(A-E), VIII(A-C)) Grading Rules For West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA Grading Rules (1999)Western Lumber Grading Rules 95

WOOD MOULDING AND MILLWORK PRODUCERS ASSOCIATION (WMMPA)

WMMPA WM 6 (1987) Industry Standard for Non-Pressure Treating of Wood Millwork

1.2 SUBMITTALS

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

SD-04 Drawings

Finish Carpentry; GA. Kiosk; GA. Vanities; GA.

Drawings showing fabricated items and special mill and woodwork items including, but not limited to vanities and kiosk. Drawings shall indicate materials and details of construction, methods of fastening, erection, and installation.

SD-14 Samples

Solid polymer material; GA.

Samples shall be of sufficient size to show patterns, color ranges, and

types, as applicable, of the material proposed to be used.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well-ventilated areas, and protected from extreme changes in temperature and humidity.

PART 2 PRODUCTS

2.1 WOOD ITEMS, SIDING, AND TRIM

The Contractor shall furnish products which optimize design by reducing the amount of wood used (engineered wood), or recycled wood products, and preservatives without arsenic or chromium when the products and methods are competitive in price or directed by the Contracting Officer.

2.1.1 Grading and Marking

Materials shall bear the grademark, stamp or other identifying marks indicating grades of material and rules or standards under which produced. Such identifying marks on a material shall be in accordance with the rule or standard under which the material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification. The inspection agency for lumber shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Except for plywood, wood structural panels, and lumber, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be architecturally exposed to view shall not bear grademarks, stamps, or other types of identifying marks.

2.1.2 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 AWP A P5 to a retention level as follows:

- a. 0.25 pcf intended for above ground use.
- b. 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 18 inches of soil, in contact with water or concrete shall be preservative-treated in accordance with WMPA WM 6. Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWP A 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 Interior Siding and Trim

2.1.5.1 Carsiding

Southern yellow pine, tongue and groove carsiding, edge V one or two side, C and better, smooth face, kiln-dried, dimensions as shown.

2.1.5.2 Trim (at Ceiling)

Southern yellow pine to match carsiding.

2.1.6 Exterior Siding and Trim

2.1.6.1 Siding

Western red cedar, tongue and groove lumber siding, edge V one or two side, B clear, sawn face, kiln-dried, dimensions as indicated.

2.1.6.2 Trim

Western red cedar, B clear, rough sawn.

2.1.7 Soffits

2.1.7.1 Hardboard and Plywood

Plywood soffits shall be western red cedar, 1/2 inch thick; plywood, DOC PS 1, exterior type, with all edges supported.

2.1.8 Solid Polymer Material

2.1.8.1 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material

Solid polymer material shall be a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting ANSI Z124.3 and ANSI Z124.6 requirements. Superficial damage to a depth of 0.01 inch shall be repairable by sanding or polishing. Material thickness shall be 1/2" thick, minimum.

Patterns and colors for all solid polymer components and fabrications shall be selected by the Contracting Officer from manufacturer's standard selection. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material. Exposed surface finish shall be matte; gloss rating of 5-20. Fabricate tops with integral backsplash and edges. Comply with solid surfacing material manufacturer's recommendations for adhesives, sealers, fabrication, and finishing.

2.1.8.2 Solid Polymer Sinks

Solid polymer sinks shall be a standard product of the solid polymer manufacturer, designed specifically to be installed in solid polymer countertops. Sinks shall be of the same polymer composition as the adjoining counter top. Sink design shall support a seam adhesive undermount installation method. Sinks shall be a single bowl configuration. Sink dimensions shall be 16 inches by 13 inches by bowl size.

2.2 NAILS

Nails shall be the size and type best suited for the purpose and shall conform to ASTM F 547. Nails shall be hot-dip galvanized or aluminum when used on exterior work. For siding, length of nails shall be sufficient to extend 1-1/2 inches into supports, including wood sheathing over framing. Screws for use where nailing is impractical shall be size best suited for purpose.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Installation of Siding

Siding shall be accurately fitted and positioned without springing or otherwise forcing siding in place. Siding to have a stain finish shall have nails set and stopped with nonstaining putty to match finished siding. Siding to have a paint finish shall have nails driven flush.

3.1.2 Vertical Lumber Siding and Carsiding

Begin application at one corner with tongue edge toward adjacent wall; trim tongue if necessary. Use a level or plumb line to ensure that first board is installed vertically. Install subsequent courses with tongue and groove edges tightly fitted together. Blind nail at maximum 16 in. on center.

1. Leave 1/8 in. gap at trim and corners, unless otherwise recommended by manufacturer, and apply sealant.

3.1.3 Ceiling Carsiding

Begin application at one corner with tongue edge toward adjacent wall; trim tongue if necessary. Install subsequent courses with tongue and groove edges tightly fitted together. Blind nail at each roof truss.

1. Leave 1/8 in. gap at trim and corners, unless otherwise recommended by manufacturer, and apply sealant.
2. Butt joints only over framing or blocking, nailing on each side of each board and staggering joints in subsequent courses.

3.2 SOFFITS

3.2.1 Wood

Panels shall be applied with edges at joints spaced in accordance with manufacturer's instructions and with all edges backed with framing members. Panels shall be nailed 3/8 inch from edges at 6 inches on center and at intermediate supports at 12 inches on center. Panels shall be installed using the maximum practical lengths.

3.3 INSTALLATION - WOOD TRIM

1. Install trim in single, unjointed lengths for openings and runs less than 10'. For longer runs, use only one piece less than 10' in any straight run. Stagger joints in adjacent members. Cope at returns and miter corners.
2. Attach trim securely with uniform joints providing for building movements. Secure woodwork to anchors or blocking built-in or directly attached to substrates.
3. Blind nail where possible. Use fine finishing nails where exposed. Set exposed nail heads for filling, except for exterior wood which receives natural finish (if any).
4. Clean woodwork and fill nail holes in preparation for finishes specified under Section 09900: PAINTING, GENERAL.

3.3.1 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.

3.3.2 Moldings 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.

3.4 WOODWORK ITEMS

3.4.1 Installation - General

Items shall be installed in accordance with the manufacturer's recommendation.

1. Condition woodwork to average prevailing humidity prior to installation.
2. Install carpentry and woodwork plumb, level, true, and straight with no distortions. Shim as required using concealed shims. Where woodwork abuts other finished work, scribe and cut for accurate fit. Before making cutouts, drill pilot holes at corners.

3.5 TABLES

TABLE I. SPECIES AND GRADE TABLES

| Grading Rules | Species | Choice | Clear | C Select | C & Better |
|---------------------|-------------------|--------|-------|----------|------------|
| NELMA Grading Rules | | | | | |
| | Eastern Cedar | | | | X |
| | Eastern Hemlock | | X | | |
| | Tamarack | | | | X |
| | Eastern W. Pine | | | | X |
| | Northern Pine | | | | X |
| | Eastern Spruce | | | X | |
| | Balsam Fir | | X | | |
| CRA RIS-01-SS | Redwood | | X | | |
| SCMA Specs | Cypress | | | X | |
| SPIB Rules | Southern Pine | | | | X |
| WCLIB Std 17 | Douglas Fir | | | | X |
| | Larch | | | | X |
| | Hemlock Fir | | | | X |
| | Mountain Hemlock | | | | X |
| | Sitka Spruce | | | | X |
| WWPA Grading Rules | | | | | |
| | Douglas Fir | | | | X |
| | Larch | | | | X |
| | Hemlock Fir | | X | | |
| | Mountain Hemlock | | | | X |
| | Western Larch | | X | | |
| | Idaho White Pine | X | | | |
| | Lodgepole Pine | | X | | |
| | Ponderosa Pine | | X | | |
| | Sugar Pine | | X | | |
| | Englemann Spruce | | X | | |
| | Douglas Fir South | | X | | |
| | Subalpine Fir | | X | | |

NOTE 1: Western Cedar under WCLIB Std 17 shall be Grade B; and under WWPA Grading Rules, Western Cedar shall be Grade B bevel for siding and Grade A for trim.

NOTE 2: Except as specified in NOTE 3 below, siding and exterior trim shall be any of the species listed above. Interior trim shall be any one of the species listed above and the highest grade of the species for stain or natural finish and one grade below highest grade of species for paint finish.

NOTE 3: Southern Yellow Pine, Douglas Fir, Larch, Western Larch, and Tamarack shall not be used where painting is required and may be used on exterior work only when approved and stained with a preservative type stain.

-- End of Section --

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07210

BUILDING INSULATION

04/01

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- 1.3 SUBMITTALS
- 1.4 DELIVERY, STORAGE AND HANDLING

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SECTION 07210

BUILDING INSULATION

04/01

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 578 (1995) Rigid, Cellular Polystyrene Thermal Insulation

1.2 REGULATORY REQUIREMENTS

Comply with fire-resistance and flammability ratings indicated on drawings and as required by State Code. Comply with code interpretations by governing authorities.

1.3 SUBMITTALS

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

SD-01 Data

Insulation Product Data; GA.

Submit manufacturer's product data for each type of insulation. Include data substantiating compliance with specified requirements.

1.4 DELIVERY, STORAGE AND HANDLING

Do not allow insulation materials to become wet or soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection.

PART 2 PRODUCTS

2.1 EXTRUDED POLYSTYRENE BOARD INSULATION

Extruded closed-cell polystyrene with integral high-density skin complying

with ASTM C 578, Type X, minimum 15 psi compressive strength, thermal resistance (R-value at 40 deg F) of 5.4 per 1 in. thickness.

2.2 FIBERGLASS BATT INSULATION

Glass fiber blankets with integral kraft paper vapor barrier or separate vapor barrier as specified below, complying with ASTM C665, type I unfaced or type II faced; thermal performance of R-13 per 3-1/2 in. thickness. Unfaced blanket shall be non-combustible as determined by ASTM E136.

2.3 NAIL-BASE, RIGID-BOARD INSULATION

2.3.1 General Requirements

Composite panel consisting of a felt skin integrally bonded to polyisocyanurate foam bonded to one or two layers of APA performance rated 7/16 inch waferboard or OSB board and a fiber reinforced facer.

2.3.2 Thickness

4.5 inch nominal thickness with an R-value of 27.1.

2.3.3 Adhesive Type

Recommended by insulation manufacturer for application.

2.3.4 Tape

Bright aluminum self-adhering type, 2-inch wide.

2.3.5 Other Materials

Materials not specifically described but required for complete, proper installation of nail base rigid board insulation, subject to acceptance of Contracting Officer

2.4 VAPOR BARRIER

6 mil sheet polyethylene, clear, for exterior wall and roof surfaces; vapor barrier may be integral with batt insulation (above).

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Thickness

Extend insulation full thickness as shown over entire surface. Cut and fit tightly around obstructions, and fill voids with insulation and mastic.

3.1.2 Manufacturer's Recommendations

Comply with manufacturer's recommendations for particular conditions of installation. If printed instructions are not available or do not apply to

project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

3.1.3 Insulation Layers

Apply a single layer of insulation of required thickness, unless otherwise shown or as required to make up total thickness.

3.1.4 Insulation Below Grade

Use extruded polystyrene Type IV, minimum 25 psi compressive strength, where insulation is below grade or in contact with soil.

3.1.5 Mastics

Mastics used with polystyrene insulation shall be approved for use by insulation manufacturer.

3.2 VAPOR BARRIER INSTALLATION

Install polyethylene vapor barrier on warm side of exterior wall and ceiling insulation. Vapor barrier shall be continuous and complete. Tape all projections thru barrier to form a seal. Lap all joints 6 inches. Tape joints and edges at ceiling and at floor.

3.3 NAIL BASE RIGID BOARD INSULATION

Apply adhesive to the insulation board as recommended by the insulation and adhesive manufacturers. Adhere boards to metal deck. Nail base rigid board insulation to metal deck. Place boards in a method to maximize contact bedding by staggering end joints. Butt edges and ends tight to adjacent board and to protrusions. Tape all joints.

3.4 MISCELLANEOUS INSULATION

Insulate miscellaneous voids and cavity spaces as designated. Apply vapor barrier where necessary to prevent infiltration of outside air.

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DIVISION 07 - THERMAL & MOISTURE PROTECTION

SECTION 07412

NON-STRUCTURAL METAL ROOFING

04/01

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SECTION 07412

NON-STRUCTURAL METAL ROOFING

04/01

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|---------------------|--|
| ASTM A 463/A 463M | (1999a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process |
| ASTM A 653/A 653M | (1999) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM A 792/A 792M | (1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process |
| ASTM B 209 | (1996) Aluminum and Aluminum-Alloy Sheet and Plate |
| ASTM B 209M | (1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric) |
| ASTM C 518 | (1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus |
| ASTM C 612 | (1993) Mineral Fiber Block and Board Thermal Insulation |
| ASTM C 991 | (1998) Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings |
| ASTM C 1177/C 1177M | (1996) Glass Mat Gypsum Substrate for Use as Sheathing |
| ASTM C 1289 | (1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board |
| ASTM D 226 | (1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing |

| | |
|-------------|--|
| ASTM D 522 | (1993a) Mandrel Bend Test of Attached Organic Coatings |
| ASTM D 523 | (1999) Specular Gloss |
| ASTM D 610 | (1995) Evaluating Degree of Rusting on Painted Steel Surfaces |
| ASTM D 714 | (1987; R 1994e1) Evaluating Degree of Blistering of Paints |
| ASTM D 968 | (1993) Abrasion Resistance of Organic Coatings by Falling Abrasive |
| ASTM D 1308 | (1987; R 1998) 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 | (1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates |
| ASTM D 2247 | (1997) 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 | (1997) Measuring Adhesion by Tape Test |
| ASTM D 4214 | (1998) Evaluating Degree of Chalking of Exterior Paint Films |
| ASTM D 4397 | (1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications |
| ASTM D 4587 | (1991) Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water- Exposure Apparatus |
| ASTM D 5894 | (1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet |
| ASTM E 84 | (1999) Surface Burning Characteristics of Building Materials |

ASTM E 96 (1995) Water Vapor Transmission of
Materials

UNDERWRITERS LABORATORIES (UL)

UL 580 (1994; Rev thru Feb 1998) Tests for Uplift
Resistance of Roof Assemblies

1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies the specified design and additional requirements contained herein. The roofing system shall be provided by the Contractor as a complete system, as tested and approved in accordance with UL 580. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

1.2.1 Non-Structural Metal Roof System

The Non-Structural Metal Roof System covered under this specification shall include the entire roofing system; the metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with UL 580. The system shall be installed on a substrate specified in Section 07210: BUILDING INSULATION. In addition, the system shall consist of panel finishes, slip sheet, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, skylights, eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of the specifications that are part of the system.

1.2.2 Manufacturer

The non-structural metal roofing system shall be the product of a manufacturer who has been in the practice of manufacturing metal roofs 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.

1.2.3 Installer

The installer shall be certified by the metal roof 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 LOADS

Non-structural Metal Roof System assemblies shall be tested as defined in UL 580 and shall be capable of resisting the wind uplift pressures shown on the contract drawings or, as a minimum, shall be approved to resist wind uplift pressures of UL 580, Class 90.

1.4 PERFORMANCE REQUIREMENTS

The metal roofing system supplied shall conform to the roof slope, the underlayment, and uplift pressures shown on the contract drawings. The Contractor shall furnish a commercially available roofing system which satisfies all the specified requirements.

1.5 SUBMITTALS

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

SD-04 Drawings

Metal Roofing; GA.

Drawings consisting of catalog cuts, flashing details, erection drawings, shop coating and finishing specifications, and other data as necessary to clearly describe materials, sizes, layouts, construction details, fasteners, and erection. Drawings shall be provided by the metal roofing manufacturer.

Warranties; GA.

At the completion of the project, signed copies of the 5-year Warranty for Non-Structural Metal Roofing System, a sample copy of which is attached to this section, and the 20-year Manufacturer's Material Warranties.

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 weather tight coverings and kept dry. Material shall not be covered with plastic where such covering will allow sweating and condensation. Plastic may be used as tenting with air circulation allowed. Storage conditions shall provide good air circulation and protection from surface staining.

1.7 WARRANTIES

The Non-Structural Metal Roofing System shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

1.7.1 Contractor's Weathertightness Warranty

The Non-Structural Metal Roofing System shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The roofing covered under this warranty shall include the entire roofing system, including but

not limited to, the roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with UL 580. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, skylights; interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of the specifications that are part of the roof system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to service design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR NON-STRUCTURAL METAL ROOF SYSTEM, and shall start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the 5 year Contractor's warranty period for the entire roofing system as outlined above.

1.7.2 Manufacturer's Material Warranties

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all Non-Structural Metal Roofing System components such as roof panels, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's 20 year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, fail structurally, or perforate under normal atmospheric conditions at the site.

Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

b. A manufacturer's 20 year exterior material finish warranty warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with ASTM D 4214; or fade or change colors in excess of 5 NBS units as measured in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing or replacing the defective coated coil material.

PART 2 PRODUCTS

2.1 ROOF PANELS

Panels shall be steel and shall have a factory color finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 30 feet. Sheets longer than 30 feet may be furnished if approved by the Contracting Officer. Panels shall be zinc-coated steel conforming to ASTM A 653/A 653M. 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. The ridge cap shall be installed as recommended by the metal roofing manufacturer. Height of corrugations, ribs, or seams, at overlap of adjacent roof sheets shall be the building manufacturer's standard for the indicated roof slope.

Products identified in this section by reference to a specific manufacturer and product name/number are identified for the purpose of establishing a standard of quality, type, and function. Products of other manufacturers may be submitted for those listed. Provided the substitution is equal in quality, type, and function and meets the specified requirements.

Panels shall conform to the requirements below.

2.1.1 Pump Stations K7, K10, L1, and L2

Bermuda roofing system, 24 gauge steel traditional design with 9 1/2 inch vertical exposure laid in horizontal layers, concealed clip fastener; UNA-clad UC-700, by Copper Sales, Inc.

2.1.2 Pump Station K12

Snap-on standing seam roofing, 24-gauge steel, 12-inch wide panel with 1 1/2-inch pan leg (1 3/4-inch high standing seam), concealed fasteners and hold-down cups; UNA-clad UC-1, by Copper Sales, Inc.

2.1.3 Restroom Type 1, Restroom Type 2

Snap-on standing seam roofing, 24-gauge steel, 12-inch wide panel with 1 1/2-inch pan leg (1 3/4-inch high standing seam), concealed fasteners and hold-down cups; UNA-clad UC-1, by Copper Sales, Inc.

2.2 ACCESSORIES

Accessories shall be compatible with the roofing furnished. Flashing, trim, metal closure strips, caps, and similar metal accessories shall be not less than the minimum thicknesses specified for roof panels. 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 panels and shall not absorb or retain water. Ridge vent, where noted on drawings, shall be Cor-A-Vent V-600 with low profile cap, cap color and flashing match roof panels, or equal, as manufactured by Cor-A-Vent, Inc., Mishawaka, IN 46546, (800) 837-8368, Fax (800) 645-6162.

2.3 FASTENERS

Fasteners for roof panels shall be zinc-coated steel, aluminum, or nylon capped steel, type and size as recommended by the manufacturer to meet the performance requirements. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be gasketed or have gasketed washers on the exterior side of the roofing to waterproof the fastener penetration. Washer material shall be compatible with the panels; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8 inch thick.

2.4 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Colors shall be selected by the Contracting Officer from manufacturer's standard colors. The exterior coating shall be a nominal 1 mil thickness consisting of a topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 0.2 mil thickness. The exterior color finish shall meet the test requirements specified below.

2.4.1 Cyclic Salt Fog/UV Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, 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 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610; and a rating of 6, over 1/16 to 1/8 inch failure at scribe, as determined by ASTM D 1654.

2.4.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 1/8 inch diameter mandrel, the coating film shall show no evidence of fracturing to the naked eye.

2.4.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM D 4587. 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 (ΔE) units in accordance with ASTM D 2244.

2.4.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking,

creepage or corrosion.

2.4.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 0.500 inch diameter hemispherical head indenter, equal to 1.5 times the metal thickness in mils, expressed in inch-pounds, with no cracking.

2.4.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

2.4.7 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

2.5 UNDERLAYMENTS

2.5.1 Felt Underlayment

Felt underlayment shall be No. 30 felt in accordance with ASTM D 226, Type II, or as indicated on the drawings.

2.5.2 Rubberized Underlayment

Rubberized underlayment shall be equal to "Ice and Water Shield" as manufactured by Grace Construction Products, "Winterguard" as manufactured by CertainTeed Corporation, or "Weather Watch Ice and Water Barrier" as manufactured by GAF Building Materials Corporation.

2.5.3 Slip Sheet

Slip Sheet shall be 5 pounds per 100 sf rosin sized unsaturated building paper.

2.6 SEALANT

Sealant shall be an elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

2.7 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds

shall be nonrunning after drying.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Improper or mislocated drill holes shall be plugged with an oversize color-marshd 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 Roofing

Side laps shall be laid away from the prevailing winds. Side and end lap distances, joint sealing, and fastening and spacing of fasteners shall be in accordance with manufacturer's standard practice. Spacing of exposed fasteners shall present an orderly appearance. Side laps and end laps of roof panels and joints at accessories shall be sealed. Fasteners shall be driven normal to the surface. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weathertight installation. Accessories shall be fastened into substrate, except as otherwise approved. Closure strips shall be provided as indicated and where necessary to provide weathertight construction.

3.1.2 Field Forming of Roof Panels for Unique Areas

When roofing panels are formed from factory-color-finished steel coils at the project site, the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. Rollformer shall be operated by the metal roofing manufacturer's approved installer. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.

3.1.3 Underlayment

Underlayment types shall be installed where shown on the drawings; they shall be installed directly over the substrate. If a roof panel rests directly on the underlayments, a slip sheet shall be installed as a top layer, beneath the metal roofing panels, to prevent adhesion. All underlayments shall be installed so that successive strips overlap the next lower strip in shingle fashion. Underlayments shall be installed in accordance with the manufacturer's written instructions. The underlayments shall ensure that any water that penetrates below the metal roofing panels will drain outside of the building envelope.

3.2 WARRANTY FORMS

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM

FACILITY DESCRIPTION _____

BUILDING NUMBER: _____

CORPS OF ENGINEERS CONTRACT NUMBER: _____

CONTRACTOR

CONTRACTOR: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

OWNER

OWNER: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

CONSTRUCTION AGENT

CONSTRUCTION AGENT: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM
(continued)

THE NON-STRUCTURAL METAL ROOF SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE NON-STRUCTURAL METAL ROOFING SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH UL 580. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE NON-STRUCTURAL METAL ROOFING SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE NON-STRUCTURAL METAL ROOF SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President) (Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOFING SYSTEM
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE NON-STRUCTURAL METAL ROOFING SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE NON-STRUCTURAL METAL ROOF DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE NON-STRUCTURAL METAL ROOFING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

**

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM
(continued)

**REPORTS OF LEAKS AND ROOF SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS ROOF SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE NON-STRUCTURAL METAL ROOF SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

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SECTION 07466

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SECTION 07466

METAL SOFFIT AND FASCIA

04/01

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|------------|--|
| ASTM B 209 | (1996) Aluminum and Aluminum-Alloy Sheet and Plate. |
| ASTM E 84 | (1998) Surface Burning Characteristics of Building Materials |

1.2 SUBMITTALS

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

SD-01 Data

Manufacturer's Product Data; GA.

Submit manufacturer's current product data including specifications, handling, storage and installation instructions, and maintenance and cleaning recommendations.

1.3 QUALITY ASSURANCE

1.3.1 Qualifications

1.3.1.1 General

Provide metal soffit and fascia systems units made of components of standard construction furnished by one manufacturer as coordinated assemblies.

1.3.1.2 Manufacturer

Five years experience in the manufacture of metal soffit and fascia systems, with 6 projects of similar size, scope and type of which 3 have been in successful use for 3 years or longer.

1.3.1.3 Contractor

Three years experience in the installation of metal soffit and fascia systems.

1.3.1.4 Personnel

For actual installation of metal soffit and fascia systems, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Protection

Protect metal soffit and fascia systems from damage during shipment, storage and construction.

1.4.2 Delivery

Deliver materials to the job site in factory sealed containers bearing the manufacturer's name and brand.

1.4.3 Damaged Material

Replace damage material prior to acceptance at no additional cost to the Owner.

1.5 PROJECT CONDITIONS

1.5.1 Existing Conditions:

1.5.1.1 Field Dimensions

Drawings do not purport to show actual dimensions, but are intended only to establish location and scope of work. Field verify dimensions and assume full responsibility for their accuracy.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Sheet Stock

ASTM B 209; 3005-H19 grade aluminum sheet.

2.1.2 Accessories

2.1.2.1 Sealants and Gaskets

Manufacturer's standard type suitable for use with installation of metal fascia and soffit; non-shrinking and non-sagging for exterior applications.

2.1.2.2 Contact Cement

Waterproof, all-weather type, cured resilient without final set.

2.1.2.3 Touch-up Paint

As recommended by manufacturer.

2.1.2.4 Fasteners

Manufacturer's standard type to suit application.

2.1.2.5 Other Materials.

Other materials not specifically described but required for complete, proper installation of metal soffit and fascia systems, subject to acceptance of Architect

2.2 FABRICATION

2.2.1 Soffit Panels

Minimum 0.019 inch sheet stock; 12 inch wide panels vented with elongated slits or small perforation.

2.2.2 Facias, Trim, Closure Pieces, Caps, In Fills

Same material, thickness, and finish (where exposed) as sheet stock; use manufacturer's standard premanufactured profiles where possible.

2.2.3 Anchorage and Support Members

Minimum 0.014 inch gage thick aluminum girts.

2.3 FINISH

2.3.1 Exposed Surfaces of Soffit and Fascia System

Two-coat acrylic type finish of color selected by the Contracting Officer from the manufacturer's standard colors.

2.3.2 Sealants and Gaskets

Color to match metal Fascia and Soffit.

2.3.3 Fasteners

Finish to match metal fascia and soffit.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Work of Other Trades

Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.

3.1.2 Verification of Conditions

Verify that metal soffit and fascia systems may be installed in accordance with original design, pertinent codes and regulations, and pertinent portions of referenced standards.

3.1.3 Discrepancies

Immediately notify Architect in writing. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.2 PREPARATION

3.2.1 Protection

Protect installed work and materials of other trades.

3.2.2 Surface Preparation

Protect fascia and soffit surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

3.3 INSTALLATION

Install metal fascia, soffit, and related components in accordance with manufacturer's instructions.

Remove site cuttings from finish surfaces.

Permanently fasten fascia and soffit system to structure; align, level, and plumb within specified tolerances.

3.4 CONSTRUCTION

3.4.1 Site Tolerances

Maximum offset from true alignment between adjacent members butting or in-line: 1/8 inch.

Maximum variation from plane or location indicated on Drawings: 1/4 inch.

3.5 REPAIR/RESTORATION

Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use materials, procedures recommended or furnished by manufacturer.

3.6 ADJUSTING

Replace damaged materials with new materials complying with specified requirements.

3.7 CLEANING

3.7.1 Site

Do not allow accumulation of scraps, debris arising from work of this section. Maintain premises in neat, orderly condition.

3.7.2 System:

Remove temporary covering and other provisions made to minimize soiling of other work.

Promptly clean surfaces not to receive metal soffit and fascia systems; repair surfaces stained, marred or otherwise damaged during work.

Clean exposed surfaces of metal soffit and fascia systems using materials and methods recommended by manufacturer.

When work is completed, remove unused materials, containers, equipment, and debris.

3.8 PROTECTION

Provide final protection and maintain conditions, in a manner acceptable to manufacturer to ensure work is without damage or deterioration at time of Substantial Completion.

-- End of Section --

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SECTION 07900

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SECTION 07900

JOINT SEALING

04/01

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM C 509 | (1994) Elastomeric Cellular Preformed Gasket and Sealing Material |
| ASTM C 570 | (1995) Oil- and Resin-Base Caulking Compound for Building Construction |
| ASTM C 734 | (1993) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering |
| ASTM C 834 | (1995) Latex Sealants |
| ASTM C 920 | (1995) Elastomeric Joint Sealants |
| ASTM C 1085 | (1991) Butyl Rubber-Based Solvent-Release Sealants |
| ASTM C 1184 | (1995) Structural Silicone-Sealants |
| ASTM D 217 | (1994) Cone Penetration of Lubricating Grease (IP50/88) |
| 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 | (1996a) Surface Burning Characteristics of Building Materials |

1.2 SUBMITTALS

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

following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Sealant; GA.

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.

1.3 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 40 to 90 degrees F when the sealants are applied.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall include the following information as applicable: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures between 40 and 90 degrees F unless otherwise specified by the manufacturer.

PART 2 PRODUCTS

2.1 BACKING

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

2.1.1 Rubber

Cellular rubber sponge backing shall be ASTM D 1056, Type 2, closed cell, Class A, round cross section.

2.1.2 Synthetic Rubber

Synthetic rubber backing shall be ASTM C 509, Option I, Type I preformed rods or tubes.

2.1.3 Neoprene

Neoprene backing shall be ASTM D 1056, closed cell expanded neoprene cord Type 2, Class C, Grade 2C2.

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 SEALANT

2.4.1 Latex

Latex Sealant shall be ASTM C 834.

2.4.2 Elastomeric

Elastomeric sealants shall conform to ASTM C 920 and the following:

- a. Polyurethane sealant: Grade NS, Class 25, Use NT.
- b. Silicone sealant: Type S, Grade NS, Class 25, Use NT.

2.4.3 TOILET ROOM SEALANT

For plumbing fixtures, provide white silicone rubber, mildew resistant; GE SCS 1702, Dow Corning 786, or equal.

2.5 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

PART 3 EXECUTION

3.1 GENERAL

3.1.1 Surface Preparation

The surfaces of joints to receive sealant or caulk shall be free of all frost, condensation and moisture. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant.

Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

3.1.4 Aluminum Surfaces

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

3.1.5 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

3.2 APPLICATION

3.2.1 Masking Tape

Masking tape may 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 dry tooled to produce a uniformly smooth surface free of wrinkles and to ensure full adhesion to the sides of the joint; the use of solvents, soapy water, etc., will not be allowed. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

-- End of Section --

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SECTION 08110

STEEL DOORS AND FRAMES

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SECTION 08110

STEEL DOORS AND FRAMES

04/01

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 A250.8 (1998) Steel Doors and Frames

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; R 1996) Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box

ASTM D 2863 (1997) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

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

DOOR AND HARDWARE INSTITUTE (DHI)

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

STEEL DOOR INSTITUTE (SDOI)

SDOI SDI-106 (1996) Standard Door Type Nomenclature

SDOI SDI-107 (1997) 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 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Steel Doors and Frames; GA.

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.

1.3 DELIVERY AND STORAGE

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

1.4 WARRANTY

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

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Doors and frames shall be factory fabricated in accordance with ANSI A250.8 and the additional requirements specified herein. Door grade shall be extra heavy duty (Grade III) unless otherwise indicated on the door and door frame schedules. Exterior doors and frames shall be designation A40 galvanized. Doors and frames shall be prepared to receive hardware conforming to the templates and information provided under Section 08700 BUILDERS' HARDWARE. Doors and frames shall be reinforced, drilled, and tapped to receive mortised hinges, locks, latches, and flush bolts as required. Doors and frames shall be reinforced for surface applied hardware. Frames shall be welded type located as shown. Door frames shall be furnished with a minimum of three jamb anchors and one floor anchor per jamb. Anchors shall be not less than 18 gauge steel or 7 gauge diameter wire. For wall conditions that do not allow the use of a floor anchor, an

additional jamb anchor shall be provided. Rubber silencers shall be furnished for installation into factory predrilled holes in door frames; adhesively applied silencers are not acceptable. Where frames are installed in plaster or masonry walls, plaster guards shall be provided on door frames at hinges and strikes. Reinforcing of door assemblies for closers and other required hardware shall be in accordance with ANSI A250.8.

Exterior doors shall have top edges closed flush and sealed against water penetration.

2.2 THERMAL INSULATED DOORS

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

2.3 STOPS

Doors and frames receiving air transfer grilles shall be equipped with plain rectangular steel stops and trim as required. Screws shall be countersunk, flat Philips head type. Unless specifically shown otherwise, frames shall be designed with loose stops on interior or room side of frame.

2.4 LOUVERS

Provide door louvers of size as indicated; see architectural drawings and schedules. Louvers shall be split-Y, security type. Face plate and frame shall be 12 ga. steel. Louvers shall be 18 ga. steel. Steel shall have prime finish. Include insect screen. Provide Air Louvers Model 1500-A, Anemostat Model PLSL, or approved equal.

2.5 FACTORY FINISH

Doors and frames shall be phosphatized and primed with standard factory primer system.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with DHI A115.1G. 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. 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 07900 JOINT SEALING.

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 selected by Contracting Officer from manufacturer's standard colors.

-- End of Section --

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SECTION 08330

OVERHEAD ROLLING DOORS

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-- End of Section Table of Contents --

SECTION 08330

OVERHEAD ROLLING DOORS

04/01

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 | (1997) Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process |
| ASTM E 84 | (1997a) Surface Burning Characteristics of Building Materials |
| ASTM E 330 | (1996) 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 Fundament HDBK-IP | (1997) Handbook, Fundamentals I-P Edition |
| ASHRAE Fundament HDBK-SI | (1997) Handbook, Fundamentals SI Edition |

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- | | |
|------------|---|
| NEMA ICS 2 | (1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC |
| NEMA ICS 6 | (1993) Industrial Control and Systems Enclosures |
| ANEMA MG 1 | (1993; Rev 1, Rev 2, Rev 3) Motors and Generators |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- | | |
|---------|------------------------------------|
| NFPA 70 | (1999) National Electrical Code |
| NFPA 80 | (1995) Fire Doors and Fire 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 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Overhead Rolling Door Unit; GA.

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

SD-04 Drawings

Overhead Rolling Door Unit; GA

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

SD-06 Instructions

Overhead Rolling Door Unit; FIO

Manufacturer's preprinted installation instructions.

SD-14 Samples

Overhead Rolling Door Unit; GA

Manufacturer's standard color samples of factory applied finishes.

1.3 DESCRIPTION

Overhead rolling doors shall be spring counterbalanced, rolling type, with interlocking slats, complete with guides, fastenings, hood, brackets, and operating mechanisms, and shall be designed for use on openings as indicated. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model/serial number of the door.

1.3.1 Wind Load Requirements

Doors and components shall be designed to withstand the minimum design wind load of 960 pa 20 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. Calculations shall be provided that prove the door design meets the design windload requirements. Recovery shall be at least 3/4 of the maximum deflection within 24 hours after the test load is removed. Sound

engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested.

1.3.2 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 number of 10 days. One complete cycle of door operation is defined as when the door is in the closed position.

1.4 DELIVERY AND STORAGE

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

1.5 WARRANTY

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

1.6 OPERATION AND MAINTENANCE MANUALS

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

PART 2 PRODUCTS

2.1 OVERHEAD ROLLING DOORS

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

2.1.1 Curtains

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

2.1.1.1 Insulated Curtains

The slat system shall supply a minimum R-value of 6.00 when calculated in accordance with ASHRAE Fundament HDBK-IP and ASHRAE Fundament HDBK-SI. Slats shall consist of a urethane core not less than 11/16-inch thick, completely enclosed within metal facings. Exterior face of slats shall be gauge as specified for curtains. Interior face shall be not lighter than 0.0209 inches. The insulated slat assembly shall have a flame spread rating of not more than 25 and a smoke development factor of not more than 50 when tested in accordance with ASTM E 84.

2.1.2 Endlocks and Windlocks

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

2.1.3 Bottom Bar

The curtain shall have a standard bottom bar consisting of two hot-dip galvanized steel angles for steel doors.

2.1.4 Guides

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

2.1.5 Barrel

The barrel shall be steel pipe or commercial welded steel tubing of proper diameter for the size of curtain. Deflection shall not exceed 0.03 inch per foot of span under full load.

2.1.6 Springs

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

2.1.7 Brackets

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

2.1.8 Hoods

Hoods shall be steel with minimum bare metal thickness of 0.0209 inches formed to fit contour of the end brackets, and shall be reinforced with steel rods, rolled beads, or flanges at top and bottom edges. Multiple segment and single piece hoods shall be provided with support brackets of the manufacturer's standard design as required for adequate support.

2.1.9 Weatherstripping

Exterior doors shall be fully weatherstripped. A compressible and replaceable weather seal shall be attached to the bottom bar. Weather seal at door guides shall be continuous vinyl or neoprene, bulb or leaf type, 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 Operation

Doors shall be operated by means of manual crank. Equipment shall be designed and manufactured for usage in non-hazardous, and Group areas.

2.1.10.1 Manual Operation

Operation shall be by means of a vertical shaft, gear box, and reduction gearing and awning-type handle. Gears shall be of high grade gray cast-iron. Gear reduction shall be provided to reduce pressure exerted on the crank to not over 35 pounds.

2.1.11 Locking

Locking shall consist of two locking discs or slide bolts provided on each interior edge of door, suitable for padlock by others, for crank operated doors.

2.1.12 Finish

Steel slats and hoods shall be hot-dip galvanized G60 in accordance with ASTM A 653, and shall be treated for paint adhesion and shall receive a factory baked-on finish coat. 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 selected by Contracting Officer from manufacturer's standard colors.

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.

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SECTION 08625

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SECTION 08625

TUBLULAR SKYLIGHTS

04/01

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 B 209 | (1996) Aluminum and Aluminum-Alloy Sheet and Plate |
| 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 | (1997) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference |
| ASTM E 331 | (1996) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference |

UNIFORM BUILDING CODE (UBC)

| | |
|-----|------------------------------|
| UBC | (1997) Uniform Building Code |
|-----|------------------------------|

1.2 SUBMITTALS

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

SD-04 Drawings

Shop Drawings ; GA.

Submit shop drawings showing construction, dimensions, and details of all components.

SD-09 Reports

Test Reports ; GA.

Submit certified, independent laboratory test reports showing compliance with the performance requirements specified below.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Air Infiltration

Air infiltration maximum 0.10 cfm per ft of crack length at 6.24 psf pressure differential when tested in accordance with ASTM E 283.

1.3.2 Water Resistance

No uncontrolled water leakage at 6.00 psf pressure differential with water rate of 5 gal/hour/sq ft when tested in accordance with ASTM E 331.

1.3.3 Uniform Load Deflection

No breakage, permanent damage to fasteners, hardware parts, or damage to make tubular skylight inoperable at both a positive and a negative load complying with requirements of the UBC. All tests shall be in accordance with ASTM E 330.

1.3.4 Uniform Load Structural

Unit to be tested at 3 X positive wind and 2 X negative wind pressure design wind pressure, acting normal to plane of roof in accordance with ASTM E 330. No breakage, permanent damage to fasteners, hardware parts, or damage to make tubular skylight inoperable or permanent deflection of any section in excess of 0.2% of its span.

PART 2 PRODUCTS

2.1 TUBLUAR SKYLIGHTS

2.1.1 Roof Dome

Injection molded polycarbonate classified as CC1 material. Thickness shall be not less than 0.125". Visible light transmission shall be 92 percent or greater. Roof dome shall contain a series of concentric, light refracting etched lines a minimum of 2" high to improve light input when sun is low on horizon.

2.1.2 Ceiling Diffuser

Injection molded, acrylic plastic classified as CC2 Plexiglas. Thickness shall be not less than 0.087". Provide prismatic design to maximize light output.

2.1.3 Roof Flashing

Aluminized steel manufactured in a single piece without seams, joints or welds and pitched for roof slope.

2.1.4 Main Tube and Reflector

Fabricate from aluminum sheet meeting the requirements of ASTM B 209, alloy and temper as required by manufacturer to suit forming operations and finish requirements, .020 inch thick. Provide exposed aluminum surface with high polished specular finish. Specular reflectance to be 92 percent and total reflectance to be 95 percent.

2.1.5 Accessories

2.1.5.1 Dress Ring

Dress Ring: 30 percent talc filled polypropylene or high impact ABS.

2.1.5.2 Sealant

Sealant: Polyurethane or copolymer - based elastomeric sealant as recommended by skylight manufacturer.

2.1.5.3 Weather Seal

Weather Seal: Medium density pile weatherstripping and light density polyvinyl chloride foam tape or UV resistant EPDM rubber.

2.1.5.4 Ceiling Diffuser Seal

Ceiling Diffuser Seal: Closed cell polyethylene foam, 3 lb per cu ft, and white polyvinyl chloride seal butt joint welded or EPDM rubber.

2.1.5.5 Fasteners

Fasteners: Same as metals being fastened or non-magnetic stainless steel or other non-corrosive metal as recommended by skylight manufacturer.

2.1.6 Fabrication

Finish, fabricate, and shop prepare all assemblies under responsibility of one manufacturer. Fabricate to allow for thermal movement of materials when subject to a temperature differential from -30 degrees F to +180 degrees F.

Provision shall be made to insure that water will not accumulate and remain in contact within system components.

PART 3 EXECUTION

3.1 INSTALLATION

Install skylights in accordance with shop drawings and manufacturer's recommendations.

-- End of Section --

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SECTION 08700

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SECTION 08700

BUILDERS' HARDWARE
04/01

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

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

ASTM F 883 (1997) Padlocks

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA L & R Directory (Effective thru Jun 1999) Directory of Certified Locks & Latches

BHMA Closer Directory (Effective thru Jul (1999) Directory of Certified Door Closers

BHMA Exit Devices Directory (Effective thru Aug 1998) Directory of Certified Exit Devices

BHMA A156.1 (1997) Butts and Hinges

BHMA A156.2 (1996) Bored and Preassembled Locks and Latches

BHMA A156.3 (1994) Exit Devices

BHMA A156.4 (1992) Door Controls - Closers

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

BHMA A156.6 (1994) Architectural Door Trim

BHMA A156.7 (1997) Template Hinge Dimensions

BHMA A156.8 (1994) Door Controls - Overhead Stops and

Holders

| | |
|--------------|---|
| BHMA A156.13 | (1994) Mortise Locks & Latches |
| BHMA A156.15 | (1995) Closer Holder Release Devices |
| BHMA A156.16 | (1989) Auxiliary Hardware |
| BHMA A156.17 | (1993) Self Closing Hinges & Pivots |
| BHMA A156.18 | (1993) Materials and Finishes |
| BHMA A156.19 | (1997) Power Assist and Low Energy Power Operated Doors |
| BHMA A156.20 | (1996) Strap and Tee Hinges and Hasps |
| BHMA A156.21 | (1996) Thresholds |
| BHMA A156.23 | (1992) Electromagnetic Locks |
| BHMA A156.24 | (1992) Delayed Egress Locks |

DOOR AND HARDWARE INSTITUTE (DHI)

| | |
|-----------------------|---|
| DHI Keying Systems | (1989) Keying Systems and Nomenclature |
| DHI Locations for CSD | (1997) Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames |
| DHI Locations for SSD | (1990) Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames |
| DHI ANSI/DHI A115.1G | (1994) Installation Guide for Doors and Hardware |
| DHI ANSI/DHI A115-W | (Varies) Wood Door Hardware Standards (Incl A115-W1 thru A115-W9) |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

| | |
|----------|--|
| NFPA 80 | (1999) Fire Doors and Fire Windows |
| NFPA 101 | (1997; Errata 97-1; TIA-97-1) Life Safety Code |
| NFPA 105 | (1999) Installation of Smoke-Control Door Assemblies |

1.2 SUBMITTALS

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

following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-07 Schedules

Hardware Schedule; GA.

Hardware schedule listing all items to be furnished. The schedule shall include for each item: the quantities; manufacturer's name and catalog numbers; 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 Keying Systems, after the keying meeting with the Contracting Officer.

1.3 PREDELIVERY CONFERENCE

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

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 SPECIAL TOOLS

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

1.6 WARRANTY

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

1.7 OPERATION AND MAINTENANCE MANUALS

Six complete copies of maintenance instructions listing routine maintenance

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

PART 2 PRODUCTS

2.1 GENERAL HARDWARE REQUIREMENTS

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

2.2 TEMPLATES

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

2.3 HINGES

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

2.4 LOCKS AND LATCHES

To the maximum extent possible, locksets, latchsets and deadlocks, and all components thereof, including cylinders and removable cores, shall be the products of a single manufacturer. Lock fronts for double-acting doors shall be rounded.

2.4.1 Mortise Lock and Latchsets

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform to BHMA A156.13, operational Grade 1. Mortise type locks and latches for doors 1-3/4 inches thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts.

2.4.2 Auxiliary Locks and Associated Products

Bored and mortise dead locks and dead latches, narrow style dead locks and dead latches, rim latches, dead latches, and dead bolts, and electric strikes shall conform to BHMA A156.5. Bolt and latch retraction shall be dead bolt style. Strike boxes shall be furnished with dead bolt and latch strikes for Grade 1.

2.4.3 Lock Cylinders (Mortise, Rim and Bored)

Lock cylinders shall comply with BHMA A156.5. Lock cylinders shall be constructed of brass, bronze, stainless steel, or nickel silver. Lock

cylinder shall have not less than six pins. Construction interchangeable cores shall be provided. Disassembly of knob or lockset shall not be required to remove core from lockset. All locksets, lockable exit devices, and padlocks shall accept same interchangeable cores.

2.4.4 Lock Trim

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA A156.2 or BHMA A156.13, knobs, lever handles, roses, and escutcheons shall be 0.050 inch thick, if unreinforced. If reinforced, the outer shell shall be 0.035 inch thick and the combined thickness shall be 0.070 inch except that knob shanks shall be 0.060 inchthick. Knob diameter shall be 2-1/8 to 2-1/4 inches. Lever handles shall be of plain design with ends returned to no more than 1/2 inch from the door face.

2.5 KEYING

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

| | |
|------------------------|--------------------------|
| Locks: | 3 change keys each lock. |
| Master keyed sets: | 5 keys each set. |
| Grandmaster keyed sets | 5 keys each set. |
| Blanks | 1 for each lock. |

The keys shall be furnished to the Contracting Officer arranged in sets or subsets as scheduled. Permanent keys shall be sent by the lock manufacturer directly to the Contracting Officer by registered mail or other approved means.

2.5.1 Keying Schedule

The Contractor shall meet with the Contracting Officer to review keys to be provided and shall provide keying schedule prior to providing keys and locks.

2.6 DOOR CLOSING DEVICES

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

2.7 DOOR CONTROLS - OVERHEAD HOLDERS

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

2.8 ARCHITECTURAL DOOR TRIM

Architectural door trim shall conform to BHMA A156.6.

2.8.1 Door Protection Plates

2.8.1.1 Kick Plates

Kick plates shall be Type J102 stainless steel. Width of plates shall be 2 inches less than door width for single doors and 1 inch less for pairs of doors. Height shall be 12 inches. Edges of metal plates shall be beveled.

2.8.2 Push Plates

2.8.2.1 Flat Plates

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

2.8.3 Door Pulls and Push/Pull Units

2.8.3.1 Door Pulls

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

2.9 AUXILIARY HARDWARE

Auxiliary hardware, consisting of door holders shall conform to BHMA A156.16. Lever extension flush bolts shall be Type L14081. Dust-proof strikes shall be Type L04011 for doors that are not fire rated. Other auxiliary hardware shall conform to BHMA A156.16.

2.10 MISCELLANEOUS

2.10.1 Metal Thresholds

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

2.10.2 Rain Drips

Extruded aluminum, not less than 0.07 inch thick, mill finished. Overhead rain drips shall be approximately 1-1/2 inches high by 2-1/2 inches projection and shall extend 2 inches on either side of the door opening width.

2.10.3 Aluminum Housed Type Weatherseals

Weatherseals of the type indicated shall consist of extruded aluminum

retainers not less than 0.07 inch wall thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be clear (natural) anodized. Weatherseal material shall be of an industrial/commercial grade. Seals shall remain functional through all weather and temperature conditions. Air leakage rate of weatherstripping shall not exceed 0.5 cubic feet per minute per lineal foot of crack when tested in accordance with ASTM E 283 at standard test conditions.

2.11 FASTENINGS

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

2.12 FINISHES

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

PART 3 EXECUTION

3.1 APPLICATION

Hardware shall be located in accordance with DHI Locations for CSD and DHI Locations for SSD, except that deadlocks shall be mounted 48 inches above finish floor, unless otherwise shown or specified. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI ANSI/DHI A115.1G or DHI ANSI/DHI A115-W. Door control devices for exterior doors such as closers and holders, shall be attached to doors with thru bolts and nuts or sex bolts. Alternate fastening methods may be approved by the Contracting Officer when manufacturers' documentation is submitted to verify that the fastening devices and door reinforcements are adequate to resist wind induced stresses. Electric hardware items and access control devices shall be installed in accordance with manufacturer's printed installation procedures.

3.1.1 Door-Closing Devices

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

3.1.2 Kick Plates and Mop Plates

Kick plates shall be installed on the push side of single-acting doors and

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

3.1.3 Auxiliary Hardware

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

3.1.4 Thresholds

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

3.1.5 Rain Drips

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

3.1.6 Weatherseals

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

3.2 HARDWARE SETS

Products identified in this Section by reference to a specific manufacturer and product name/number are identified for the purpose of establishing a standard of quality, type and function. Products of other manufacturers may be submitted for those listed, provided the substitution is equal in quality, type, and function and meets the requirements specified.

3.2.1 Group 1 - Toilet and Changing Room

| | |
|---|-------|
| 1-1/2 Pair Butts: Stanley FBB 199 4-1/2 x 4-1/2 x NRP | 626 |
| 1 Deadlock: Corbin Russwin DL4017 (installed 60" A.F.F.) | 626 |
| 1 Push: 8" x 16" x 16 ga. | 630 |
| 1 Pull: Brookline 807 | 630 |
| 1 Closer: Corbin Russwin DC2200 x A4 x M72 (Low Opening Resistance) | 689 |
| 1 Threshold: Reese S204A | Alum. |
| 1 Sweep: Reese 712 | DUR |
| 1 Wallstop | |
| 1 Kickplate: 12" x 2" L.D.W. | 630 |
| 1 Raindrip | |

3.2.2 Group 2 - Mechanical Room

| | |
|---|-------|
| 1-1/2 Pair Butts: Stanley FBB 199 4-1/2 x 4-1/2 x NRP | 626 |
| 1 Lockset: Corbin Russwin ML2255 x LSA | 626 |
| 1 O.H. Holder: Corbin Russwin DH5202 | 626 |
| 1 Threshold: Reese S204A | Alum. |
| 1 Sweep: Reese 712 | DUR |
| 1 Raindrip | |

3.2.3 Group 3 - Vending

Each door shall receive:

| | |
|---|-------|
| 1-1/2 Pair Butts: Stanley FBB 199 4-1/2 x 4-1/2 x NRP-Hinges shall Provide Full 180 degree opening of door in open position. | 626 |
| 1 Lockset (active): Corbin Russwin ML2255 x LSA | 626 |
| 2 Flush Bolts (inactive): Ives 458 | 626 |
| 1 Threshold: Reese S204A | Alum. |
| 1 Sweep: Reese 967 | DUR |
| 1 Astragal: Reese 87 | DUR |

Holder/Stop

At door locations with concrete walks (see drawings)

| | |
|--|-------|
| 1 Cane Bolt: Stanley CD1009, 12 inch. - Coordinate location of drilled hole in concrete slab for door in full open position. | US2C |
| 1 Wallstop At door locations with no concrete walk (see drawings) | |
| 1 Wall type holder: Glynn-Johnson W45AX | Alum. |
| 1 Raindrip | |

3.2.4 Group 4 - Pump House

| | |
|---|-------|
| 1-1/2 Pair Butts: Stanley FBB 199 4-1/2 x 4-1/2 x NRP | 626 |
| 1 Lockset (active): Corbin Russwin ML2255 x LSA | 626 |
| 1 Closer: Corbin Russwin DC2200 x A5 x M72 | 630 |
| 1 Threshold: Reese S204A | Alum. |
| 1 Sweep: Reese 967 | DUR |
| 1 Rain Drip | |
| 1 Weatherseal | Alum. |

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SECTION 09260

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SECTION 09260

GYPSUM BOARD SYSTEMS

04/01

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|--|
| ASTM C 36 | (1997) Gypsum Wallboard |
| ASTM C 475 | (1994) Joint Compound and Joint Tape for Finishing Gypsum Board |
| ASTM C 840 | (1997) Application and Finishing of Gypsum Board |
| ASTM C 1002 | (1996a) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases |
| ASTM C 1047 | (1995) Accessories for Gypsum Wallboard and Gypsum Veneer Base |

1.2 DELIVERY, STORAGE, AND HANDLING

Schedule delivery to minimize storage periods at project site. Deliver materials in accordance with manufacturer's instructions; ship unopened containers or packages, fully identified with manufacturer's name, brand, type and grade. Store boards flat with uniform support. Protect from weather and damage as recommended by manufacturer.

PART 2 PRODUCTS

2.1 ACCEPTABLE GYPSUM BOARD MANUFACTURERS

Products identified in this Section by reference to a specific manufacturer and product name/number are identified for the purpose of establishing a standard of quality, type, and function. Unless otherwise indicated, gypsum board products and accessories of the following manufacturers, or approved equal, may be substituted for those listed, provided the substitution is equal in quality, type, and function and meets the specified requirements:

a. Georgia-Pacific (G-P).

b. National Gypsum/Gold Bond Building Products Div. U. S. Gypsum (USG).

2.2 INTERIOR GYPSUM BOARD

Exposed Board Surface: 5/8" thick gypsum wallboard unless otherwise indicated, complying with ASTM C 36, with paper face surface suitable to receive decorated finish and long edges tapered to receive standard joint treatment, in lengths as required for minimum number of joints.

2.3 GYPSUM BOARD FASTENERS

2.3.1 General

Provide type and size recommended by manufacturer for applications shown. Review fire-rated assembly requirements for fastener spacing. In general, fasten gypsum board with self-drilling screws designed for gypsum board, ASTM C 1002.

2.3.2 Screws

Screws shall be self-tapping when used with metal framing up to 12 gage. Heads shall be designed for covering with finishing compound if exposed in face layers.

2.4 GYPSUM BOARD METAL TRIM ACCESSORIES

Provide trim accessories of sizes required for applications shown, fabricated of galvanized steel, complying with ASTM C 1047 as follows:

2.4.1 External Corners

Metal corner bead with smooth rigid nose and perforated and knurled metal flanges.

2.4.2 Control Joints

Where shown and as required in Part 3 Execution of this section, one-piece joint assembly of non-corrosive metal or extruded vinyl with continuous unperforated V-slot for insertion into joint and perforated flanges for attachment to face of gypsum board with slot opening covered with removable strip.

2.4.3 Where Face Panels Abut Dissimilar Materials, at Reveals, and Where Designated:

Shaped metal trim designed to be concealed by taping operations; USG No. 200-B metal trim, Fry Reglet FDM-625, or approved equal.

2.4.4 Exposed Panel Edges and Where Designated

J-shape casing beads designed to be concealed by taping.

2.5 JOINT TREATMENT MATERIALS

2.5.1 Joint Tape

Joint Tape: Plain or perforated paper, ASTM C 475.

2.5.2 Joint Compound

Joint Compound: Factory-prepackaged vinyl based products, ASTM C 475. Provide in dry powder form for mixing with water at jobsite or factory pre-mixed, for single or two-compound treatment.

2.5.3 Taping Compound

Taping compound shall be formulated for embedding tape and first coat over fasteners and flanges of corner beads and edge trim.

2.5.4 Topping Compounds

Topping compounds shall be formulated for fill (second) and finish (third) coats.

2.5.5 All Purpose Compounds

All purpose compounds shall be formulated for use as both taping and topping compounds.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 General

Comply with ASTM C 840, unless otherwise recommended by gypsum board manufacturer.

3.1.2 Examination of Conditions

Examine substrates and conditions; notify of detrimental conditions. Do not proceed until unsatisfactory conditions are corrected.

3.1.3 Tolerances

Do not exceed 1/8" in 8'-0" variation from plumb or level in line or surface; except at joints between units, do not exceed 1/16" variation between planes of abutting edges or ends. Shim as required to comply with specified tolerances.

3.1.4 Framing and Blocking

Provide additional framing and blocking as required to support gypsum board at openings and cutouts, and to support built-in anchorage and attachment devices for other work.

3.1.5 Control Joints

Form control joints in gypsum board construction where indicated below. Allow 1/2" continuous opening between edges of adjacent drywall boards to allow for insertion of control joint trim accessory.

3.2 SINGLE-LAYER GYPSUM BOARD APPLICATIONS

3.2.1 Partition/Walls

Partition/Walls: For heights of 8'-1" or less, apply gypsum board vertically or horizontally at contractor's option. For heights greater than 8'-1" or for areas less than 4' wide, apply vertically. Use floor-to-ceiling length boards for vertical applications and locate edge joints over supports, but offset at least one stud on opposite faces of partition/walls. Use maximum practical length boards for horizontal applications and locate end joints over supports and stagger in alternate courses of board.

3.2.2 Ceilings

Ceilings: Apply gypsum board with long dimension at right angles to supports with end butt joints located over supports. Use maximum practical length boards to minimize end butt joints. Stagger end joints in alternate courses of boards and locate as far away from center of ceiling as possible.

3.2.3 Supports

Supports: Fasten gypsum board with screws. Comply with manufacturer's instructions for fastening, but do not exceed 12" o.c. spacing.

3.3 CONTROL JOINTS

Gypsum panel surfaces shall be isolated with control joints where:

- a. Partition, furring, or column fireproofing abuts a structural element (excepts floor) or dissimilar wall or ceiling.
- b. Ceiling abuts a structural element, dissimilar wall or partition, or other vertical penetration.
- c. Construction changes within plane of partition or ceiling.
- d. Partition or furring run exceeds 30 ft.
- e. Wings of "L", "U" and "T"-shaped ceiling areas are joined.

3.4 GYPSUM BOARD FINISHING

3.4.1 Temperature and Ventilation

Do not install joint treatment compounds unless conditions comply with minimum temperature and ventilation requirements recommended by manufacturer.

3.4.2 Finishing

Finish exposed gypsum board surfaces with joints, corners, and exposed edges reinforced or trimmed as specified, and with joints, fasteners, accessory flanges, and surface defects filled with joint compound in accordance with manufacturer's recommendations for a smooth, flush surface.

3.4.3 Acceptance

Gypsum board finishing work will not be considered acceptable if corners or edges do not form true, level, or plumb lines, or if joints, fastener heads, flanges of accessories, or defects are visible after application.

3.5 PROTECTION

Comply with proper procedures for protection of completed gypsum board work from damage or deterioration until acceptance of work

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SECTION 09310

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04/01

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- 3.3 INSTALLATION OF WALL TILE
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SECTION 09310

CERAMIC TILE

04/01

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 A108.5 | (1992) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar |
| ANSI A108.10 | (1992) Installation of Grout in Tilework |
| ANSI A118.1 | (1992) Dry-Set Portland Cement Mortar |
| ANSI A118.6 | (1992) Ceramic Tile Grouts |
| ANSI A137.1 | (1988) Ceramic Tile |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-------------|---|
| ASTM C 373 | (1988; R 1994) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products |
| ASTM C 648 | (1998) Breaking Strength of Ceramic Tile |
| ASTM C 1026 | (1987; R 1996) Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling |
| ASTM C 1027 | (1984; R 1990) Determining Visible Abrasion Resistance of Glazed Ceramic Tile |

ASTM C 1028 (1996) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method

TILE COUNCIL OF AMERICA (TCA)

TCA Hdbk (1997) Handbook for Ceramic Tile Installation

1.2 SUBMITTALS

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

SD-01 Data

Tile; GA.

SD-14 Samples

Tile; GA.

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

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover in accordance with manufacturer's instructions.

1.4 ENVIRONMENTAL REQUIREMENTS

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

1.5 WARRANTY

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

PART 2 PRODUCTS

2.1 TILE

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 90 lbs and 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 0.50 maximum percent in accordance with ASTM C 373.

Floor tile shall have a minimum coefficient of friction of 0.60 wet and dry in accordance with ASTM C 1028. Floor tile shall be Class IV-Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C 1027 for abrasion resistance as related to foot traffic.

2.1.1 Quarry Tile

Quarry tile and trim shall be unglazed with smooth surface. Tile shall be 6 x 6 x 1/2 inch. Color shall be selected by the Contracting Officer from manufacturer's standard colors.

2.1.2 Glazed Wall Tile

Where ceramic base is indicated in rooms with concrete floor, provide 4-1/2" high x 4-1/2" long glazed tile specifically designed for this application, with cove base and rounded top. Color shall be selected by the Contracting Officer from manufacturer's standard colors.

2.2 MORTAR, GROUT, AND ADHESIVE

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

2.2.1 Dry-Set Portland Cement Mortar

ANSI A118.1.

2.2.2 Ceramic Tile Grout

ANSI A118.6;

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

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

| TYPE | WALLS | FLOORS |
|------------------------------|-------------------|--------------------|
| Dry-Set Mortar | 1/8 inch in 8 ft. | 1/8 inch in 10 ft. |
| Organic Adhesives | 1/8 inch in 8 ft. | 1/16 inch in 3 ft. |
| Latex portland cement mortar | 1/8 inch in 8 ft. | 1/8 inch in 10 ft. |
| Epoxy | 1/8 inch in 8 ft. | 1/8 inch in 10 ft. |

3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with the TCA Hdbk, method W202.

3.3.1 Dry-Set Mortar and Latex-Portland Cement Mortar

Dry-set 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 Hdbk, methods F113 and F115.

3.4.1 Dry-Set and Latex-Portland Cement

Dry-set 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.

3.4.2 Ceramic Tile Grout

Ceramic Tile grout shall be prepared and installed in accordance with ANSI A108.10.

3.5 EXPANSION JOINTS

Joints shall be formed as indicated and sealed as specified in Section 07900 JOINT SEALING.

3.5.1 Walls

Expansion joints shall be provided at control joints in backing material. Wherever backing material changes, an expansion joint shall be installed to separate the different materials.

3.5.2 Floors

Expansion joints shall be provided over construction joints, control joints, and expansion joints in concrete slabs. Expansion joints shall be provided where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 24 to 36 feet each way in large

interior floor areas and 12 to 16 feet each way in large exterior areas or areas exposed to direct sunlight or moisture. Expansion joints shall extend through setting-beds and fill.

3.6 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

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SECTION 09900

PAINTING, GENERAL
04/01

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 Limit Values (1996) Threshold Limit Values for Chemical Substances and Physical Agents and Biological exposure Indices

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4214 (1998) Evaluating Degree of Chalking of Exterior Paint Films

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1632 (Basic) Varnish, Asphalt

CID A-A-2867 Coating, Polyurethane, Single Component Moisture Cure, Aliphatic

CID A-A-2962 (Rev A) Enamel, Alkyd (Metric)

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 5 (1995) Zinc Dust, Zinc Oxide and Phenolic Varnish Paint

SSPC SP 1 (1982) Solvent Cleaning

SSPC SP 2 (1995) Hand Tool Cleaning

SSPC SP 3 (1995) Power Tool Cleaning

SSPC SP 6 (1994) Commercial Blast Cleaning

SSPC SP 7/NACE 4 (1994) Brush-Off Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation;

submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01330: SUBMITTAL PROCEDURES:

SD-01 Data

Paint; FIO.

The names, quantity represented, and intended use for the proprietary brands of materials proposed to be substituted for the specified materials regardless of quantities in states where VOC content limitations apply.

SD-06 Instructions

Mixing and Thinning; FIO. Application; FIO.

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings. Detailed application instructions for textured coatings shall be provided.

1.3 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 40 and 95 degrees F. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

1.4 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 45 and 95 degrees F when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings.

Water-thinned coatings shall be applied only when ambient temperature is between 50 and 90 degrees F. Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

1.5 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.

1.5.1 Worker Exposures

Exposure of workers to hazardous chemical substances shall not exceed limits established by ACGIH Limit Values, or as required by a more stringent applicable regulation.

1.5.2 Toxic Compounds

Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless approved by the Contracting Officer.

1.5.3 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material safety data 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.

1.5.4 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 requirements listed in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 50 gallons or less, an approved first-line proprietary paint material with similar intended formulation, usage and color to that specified may be used. 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 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.

2.1.3 Chromium

Paints containing zinc chromate or strontium chromate pigments shall not be used.

2.1.4 Volatile Organic Compound (VOC) Content

Paints shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.2.1 Ferrous Surfaces

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to SSPC SP 2, power tools according to SSPC SP 3 or by sandblasting according to SSPC SP 7/NACE 4. Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

3.2.2 Nonferrous Metallic Surfaces

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1.

3.3 MIXING AND THINNING

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 1 pint of suitable thinner per gallon. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.3.1 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.4 APPLICATION

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

3.4.1 Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed established limits.

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 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.

3.4.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

3.4.5 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

3.5 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.

3.6 SURFACES NOT TO BE PAINTED

Surfaces in the following areas shall not be painted:

1. Concrete.
2. Metals fully embedded in concrete (except aluminum)
3. Factory name plates.
4. Aluminum items, including guardrail.

3.7 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.

3.8 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.

3.8.1 Exterior Painting Schedule

3.8.1.1 Ferrous Metal and PVC - Unprimed, Galvanized & Prefinished

Includes exposed rooftop mechanical equipment, metal and PVC stacks and vents, galvanized flashings, ductwork, equipment supports, mechanical piping, conduit, electrical equipment, panelboards, meter boxes, miscellaneous metal items which shall be painted as follows.

- a. 1 coat rust inhibiting primer, except for galvanized surfaces use 1 coat galvanized metal latex primer. Omit primer on prefinished surfaces, unless required as barrier coat.
- b. 2 coats enamel (alkyd, flat).

3.8.1.2 Ferrous Metal - Primed & Prefinished

Includes miscellaneous metal fabrications, steel doors and frames, exposed structural lintels which shall be painted as follows.

- a. Touch up bare metal with primer.
- b. 2 coats Effecto Enamel (alkyd, gloss).

3.8.1.3 Wood - Stained

Includes siding and trim which shall be painted with 2 coats semi-transparent stain.

3.8.2 Interior Painting Schedule

3.8.2.1 Block Masonry

Block masonry, where scheduled, shall be painted as follows.

- a. 1 coat block filler.
- b. 2 coats epoxy (water borne, gloss).

3.8.2.2 Ferrous Metal - Adjacent or Near to Painted Surfaces

Includes factory-primed and baked-enamel-prefinished grills, louvers, ductwork, conduit, piping, electrical panel covers, baseboard radiation, convector cabinets, access covers, equipment enclosures, raceways and similar appurtenances which shall be painted to match adjacent or near surfaces, except as designated otherwise below.

3.8.2.3 Ferrous Metal - Primed & Finished

Includes touch-up primer and 2 coats enamel (alkyd, gloss).

3.8.2.4 Hardwood - Natural Finish

Includes carsiding and trim to be painted as follows.

- a. 1 coat sanding sealer.
- b. 2 coats clear finish (alkyd-natural/stain, satin).

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SECTION 09915

COLOR SCHEDULE

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PART 3 EXECUTION (Not Applicable)

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SECTION 09915

COLOR SCHEDULE

04/01

PART 1 GENERAL

1.1 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.

1.2 SUBMITTALS

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

SD-14 Samples

Color Schedule; FIO

Two sets of color boards, 30 days after the Contractor is given notice to proceed, complying with the following requirements:

- 1) Color boards shall reflect all actual finish textures, patterns, and colors required for this contract.
- 2) Materials shall be labeled with the finish type, manufacturer's name, pattern, and color reference.
- 3) 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.
- 4) Samples for this color board are required in addition to samples required of other specification sections.

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

Colors, patterns and textures required for exterior and interior finishes, including both factory applied and field applied colors shall be selected by the Contracting Officer from manufacturer's standard colors, unless otherwise noted. See individual technical specification sections for additional information.

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.

2.2.2 Exterior Roof

Roof color shall apply to exterior roof surfaces including sheet metal flashings and copings, mechanical units, roof trim, pipes, conduits, electrical appurtenances, and similar items.

2.2.3 Interior Wall Finishes

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.

2.2.4 Interior Ceiling Finishes

Ceiling colors shall apply to ceiling surfaces including soffits, furred down areas, grilles, diffusers, registers, and access panels.

PART 3 EXECUTION (Not Applicable)

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SECTION 10170

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SECTION 10170

PLASTIC TOILET COMPARTMENTS

04/01

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 666 (1996b) Annealed or Cold-Worked Austenitic Stainless Steel, Sheet, Strip, Plate and Flat Bar

1.2 SUBMITTALS

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

SD-01 Data

Product Data; GA.

Submit detailed material and fabrication specifications and installation instructions. Include catalog cuts of hardware, anchors, fastenings and other data as required.

SD-14 Samples

Color Selections; GA.

Submit samples of manufacturer's standard colors for selection.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Subject to compliance with the specified requirements, provide plastic toilet compartments by Accurate Partitions Corp., Comtec Industries, General Partitions Manufacturing Corp., Santana Products Company, or approved equal

2.2 TOILET COMPARTMENTS

2.2.1 Style

Floor-mounted, overhead-braced.

2.2.2 Panels, Doors, and Pilasters

High-density polyethylene (HDPE) with homogenous color throughout. Provide material not less than 1 in. thick with seamless construction and eased edges in color selected by Contracting Officer from manufacturer's standard colors.

2.2.3 Pilaster Shoes and Sleeves (Caps)

ASTM A 666, Type 302 or 304 stainless steel, not less than 0.312 in. thick and 3 in. high, finished to match hardware.

2.2.4 Stirrup Brackets

Manufacturer's standard ear or U-brackets for attaching panels and screens to walls and pilasters of clear anodized aluminum or stainless steel.

2.2.5 Full-Height (Continuous) Brackets

Manufacturer's standard design for attaching panels and screens to walls and pilasters of clear anodized aluminum or stainless steel.

2.2.6 Overhead Bracing

Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.

2.2.7 Heat-Sink Strip

Manufacturer's standard continuous, extruded-aluminum strip in manufacturer's standard finish.

2.2.8 Coat Hook and Bumper

Inside compartment on in-swinging doors and outside of door on out-swinging doors of handicap accessible compartments if door opens against an adjacent wall.

2.2.9 Hardware and Accessories

Manufacturer's standard design, heavy-duty operating hardware and accessories of clear anodized aluminum or stainless steel.

2.2.10 Anchorages and Fasteners

Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide hex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other

rust-resistant, protective-coated steel.

2.3 FABRICATION

2.3.1 Compartment System

Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

2.3.2 Heat Sink Strips

Provide aluminum heat-sink strips at exposed bottom edges of HDPE units to prevent burning.

2.3.3 Pilasters

Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

2.3.4 Wall Hung Screens

Provide wall hung screens in sizes indicated of same construction and finish as compartment panels.

2.3.5 Door Size

Unless otherwise indicated, provide 24 in. wide in-swinging doors for standard toilet compartments and 36 in. wide out-swinging doors with a minimum 32 in. wide clear opening for compartments indicated to be handicapped accessible.

2.3.6 Doors

Provide the following for each door in compartment system:

2.3.6.1 Hinges

Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return to fully closed position.

2.3.6.2 Latch and Keeper

Recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at

compartments indicated to be handicapped accessible.

2.3.6.3 Coat Hook Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.

2.3.6.4 Door Bumper Manufacturer's standard rubber-tipped bumpers at out-swinging doors.

2.3.6.5 Door Pull Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

PART 3 EXECUTION

3.1 INSPECTION

3.1.1 Examine Conditions

Examine substrates and conditions under which toilet compartments and related items are to be installed.

3.1.2 Notification of Detrimental Conditions

Notify of conditions detrimental to proper and timely completion of the work.

3.1.3 Correction of Unsatisfactory Conditions

Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

3.2.1 General

Install compartments rigid, straight, plumb and level, with the panels laid out as shown. Provide clearances of not more than 1/2 in. between pilasters and panels, and not more than 1 in. between panels and walls. Locate wall bracket so that holes for wall anchorages occur in masonry or tile joints. Secure panels to supporting walls with manufacturer's recommended anchoring devices in accordance with shop drawings and manufacturer's instructions. Secure floor supports to the floor with not less than two lead expansion shields and sheet metal screws.

3.2.2 Securing Pilasters

Secure pilasters to supporting floor with specified anchorage devices. Level, plumb, and tighten with leveling device. Set tops of doors parallel with overhead brace when doors are in the closed position.

3.2.3 Head Rail

Head rail shall extend across front of each toilet compartment and be

securely anchored in a stainless steel wall bracket where it meets wall. End toilet compartment shall have an additional head rail running length of last panel and anchored securely to back wall.

3.3 HARDWARE ADJUSTMENTS

Adjust and lubricate hardware for proper operation after installation.

3.4 PROTECTION AND CLEANING

Protect units during delivery, storage, and after erection so that there will be no indication of use or damage at the time of acceptance. Replace damaged work.

3.5 FINAL ADJUSTMENTS

Perform final adjustments to pilaster leveling devices, door hardware, and other operating parts prior to final inspection. Clean exposed surfaces of compartments, hardware, fittings and accessories, and touch up minor scratches and other finish imperfections using materials and methods recommended by compartment manufacturer.

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SECTION 10430

EXTERIOR SIGNAGE

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SECTION 10430

EXTERIOR SIGNAGE

04/01

PART 1 GENERAL

1.1 REFERENCES

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

ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1980; R 1993) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; Rev 1994) Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M (1997a) Carbon Structural Steel

ASTM A 123/A 123M (1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 570/A 570M (1996) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM A 653/A 653M (1997) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 924/A 924M (1997) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM B 26/B 26M (1997) Aluminum-Alloy Sand Castings

ASTM B 62 (1993) Composition Bronze or Ounce Metal Castings

ASTM B 108 (1997) Aluminum-Alloy Permanent Mold Castings

| | |
|-------------|--|
| ASTM B 209 | (1996) Aluminum and Aluminum-Alloy Sheet and Plate |
| ASTM B 209M | (1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric) |
| ASTM B 221 | (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes |
| ASTM B 221M | (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) |
| ASTM C 1036 | (1991; R 1997) Flat Glass |
| ASTM D 3841 | (1992) Glass-Fiber-Reinforced Polyester Plastic Panels |
| ASTM E 84 | (1996a) Surface Burning Characteristics of Building Materials |

AMERICAN WELDING SOCIETY (AWS)

| | |
|----------|---|
| AWS C1.1 | (1966) Recommended Practices for Resistance Welding |
| AWS D1.1 | (1996) Structural Welding Code - Steel |
| AWS D1.2 | (1990) Structural Welding Code - Aluminum |

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 | (1996; Errata 96-4) National Electrical Code |
|---------|--|

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

| | |
|--------------|--|
| SAE AMS 3611 | (1994; Rev D) Plastic Sheet, Polycarbonate General Purpose |
|--------------|--|

MINNESOTA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MMUTCD)

| | |
|--------|---|
| MMUTCD | Minnesota Manual on Uniform Traffic Control Devices |
|--------|---|

1.2 GENERAL

All exterior signage shall be provided by a single manufacturer. Exterior signage shall be of the design, detail, sizes, types, and message content shown on the drawings, shall conform to the requirements specified, and shall be provided at the locations indicated. Signs shall be complete with lettering, framing as detailed, and related components for a complete installation.

1.3 CHARACTER PROPORTIONS AND HEIGHTS

Letters and numbers on indicated signs for handicapped-accessible buildings shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10. Characters and numbers on indicated signs shall be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case letter "X". Lower case characters are permitted.

1.4 Raised and Brailled Characters and Pictorial Symbol Signs (Pictograms)

Letters and numbers on indicated signs which designate permanent rooms and spaces in handicapped-accessible buildings shall be raised 1/32-inch upper case, sans serif or simple serif type and shall be accompanied with Grade 2 Braille. Raised characters shall be at least 5/8 inch in height, but no higher than 2 inches. Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram shall be 6 inches minimum in height. Indicated accessible facilities shall use the international symbol of accessibility.

1.5 SUBMITTALS

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

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, each sign type, and message shall be included.

1.6 QUALIFICATIONS

Signs, plaques, and dimensional letters 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.

1.7 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 in accordance with manufacturer's instructions.

1.8 WARRANTY

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

PART 2 PRODUCTS

2.1 MODULAR EXTERIOR SIGNAGE SYSTEM

Exterior signage shall consist of a system of coordinated directional, identification, and regulatory type signs located where shown. Dimensions, details, materials, message content, and design of signage shall be as shown.

2.1.1 Traffic Signs

Traffic signs shown for roads and parking areas shall be in accordance with the MMUTCD designation shown.

2.1.2 Recreation Area Signs

Signs for recreation trailheads and trails shall be as shown and in accordance with the MMUTCD designation shown.

2.1.3 Posts

One-piece aluminum or galvanized steel posts shall be provided with minimum 0.125 inch wall thickness. Posts shall be designed to accept panel framing system described. The post shall be designed to permit attachment of panel framing system without exposed fasteners. Caps shall be provided for each post.

2.2 METAL PLAQUES

Design and location of plaques shall be as shown.

2.2.1 Cast Metal Plaques

2.2.1.1 Fabrication

Cast metal plaques shall have the logo, emblem and artwork cast in the base relief technique. Plaques shall be fabricated from bronze.

2.2.1.2 Size

Plaque size shall be as shown.

2.2.1.3 Border

Border shall be radius as shown

2.2.1.4 Background

Background texture shall be fine pebble.

2.2.1.5 Mounting

Mounting shall be concealed.

2.2.1.6 Finish

Finishes shall consist of bronze with dark finish oxidized background. Letters shall be satin polished and entire plaque sprayed with two coats of clear lacquer.

2.3 SHOP FABRICATION AND MANUFACTURE

2.3.1 Factory Workmanship

Work shall be assembled in the shop, as far as practical, 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 practical. Items specified to be galvanized shall be by hot-dip process after fabrication if practical. Galvanization shall be in accordance with ASTM A 123/A 123M and ASTM A 653/A 653M, as applicable. Other metallic coatings of steel sheet shall be in accordance with ASTM A 924/A 924M. Joints exposed to the weather shall be formed to exclude water. Drainage and weep holes shall be included as required to prevent condensation buildup.

2.3.2 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.

2.4 COLOR, FINISH, AND CONTRAST

For buildings required to be handicapped-accessible, the characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast with their background - either light characters on a dark background or dark characters on a light background.

PART 3 EXECUTION

3.1 INSTALLATION

Signs, plaques, or dimensional letters 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 and fastener materials shall be in accordance with approved manufacturer's instructions for the indicated substrate. Anchorage not otherwise specified or indicated shall include slotted inserts, expansion shields, and powder-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 manufacturer's instructions. After signs are completed and inspected, the Contractor shall cover all project identification, directional, and other signs which may mislead the public. Covering shall be maintained until instructed to be removed by the Contracting Officer or until the facility is to be opened for business. Signs shall be cleaned, as required, at time of cover removal.

3.2 HARDWARE SETS

Products identified in this section by reference to a specific manufacturer and product name/number are identified for the purpose of establishing a standard of quality, type, and function. Products of other manufacturers may be submitted for those listed, provided the substitution is equal in quality, type, and function and meets the specified requirements.

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SECTION 10520

FIRE PROTECTION SPECIALTIES

04/01

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SECTION 10520

FIRE PROTECTION SPECIALTIES

04/01

PART 1 GENERAL

1.1 SUBMITTALS

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

SD-01 Data

Product Data; GA.

Submit manufacturer's current product data including specifications, handling, storage and installation instructions, and maintenance recommendations.

1.2 QUALITY ASSURANCE

1.2.1 Qualifications

1.2.1.1 General

Provide fire protection specialties units made of components of standard construction furnished by one manufacturer as coordinated assemblies.

1.2.1.2 Manufacturer

Five years experience in the manufacture of fire protection specialties.

1.2.1.3 Personnel

For actual installation of fire protection specialties, use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, thoroughly familiar with requirements of work.

1.2.2 Regulatory Requirements

1.2.2.1 UL Listing

Provide portable fire extinguishers which are UL listed and bear UL "Listing Mark" for type, rating and classification of extinguisher listed.

1.2.3 Field Samples

If requested, furnish sample of each type of fire protection specialties to the Contracting Officer for review prior to manufacture/installation. Contracting Officer will forward approved sample to the project site for installation.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Protection

Protect fire protection specialties from damage during shipment, storage and construction.

1.3.2 Delivery

Deliver materials to the job site in factory sealed containers bearing the manufacturer's name and brand.

1.3.3 Damaged Material

Replace damage material prior to acceptance at no additional cost to the Owner.

1.4 PROJECT CONDITIONS

Existing conditions: Inspect the project prior to installation. If conditions do not meet approval, notify the Contracting Officer's Representative. Proceeding without notification implies acceptance of conditions.

PART 2 PRODUCTS

2.1 MANUFACTURER

Standard of Quality: Design is based on products of J.L. Industries, Bloomington, MN.

2.2 OTHER ACCEPTABLE MANUFACTURERS

Subject to compliance with requirements, acceptable manufacturers and products are as follows.

- a. Amerex Corporation, Trussville, AL.
- b. Larsen Manufacturing Company, Minneapolis, MN.
- c. Manufacturer of equal approved products.

2.3 COMPONENTS

2.3.1 Fire Extinguishers

Fire Extinguishers: Fully charged and ready for use at final acceptance. Size, type indicated in schedule at end of this section.

2.3.2 Standard Wall Hanger Brackets

Size in accordance with fixture size where indicated by symbol on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Work of Other Trades

Prior to commencing work, carefully inspect and verify that work is complete to point where this installation may properly commence.

3.1.2 Verification of Conditions

Verify that fire protection specialties may be installed in accordance with original design, pertinent codes and regulations, and pertinent portions of referenced standards.

3.1.3 Discrepancies

Immediately notify Contracting Officer's Representative. Do not proceed with installation in areas of discrepancy until fully resolved. Commencement of installation signifies acceptance of surface conditions.

3.2 INSTALLATION

Install plumb, true, square in neat, rigid, substantial manner. After erection, clean surfaces. Adjust hardware, leave in good operating condition.

3.3 SCHEDULE

| <u>Drawing Symbol</u> | <u>Size & Type</u> | <u>Rating</u> | <u>General Location</u> |
|---------------------------|---------------------------------------|----------------|-----------------------------|
| FE-1 | 10# AGBC Dry Chemical (bracket) | 4A:60B:C UL | Pump House |

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DIVISION 10 - SPECIALTIES

SECTION 10800

TOILET ACCESSORIES

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SECTION 10800

TOILET ACCESSORIES

04/01

PART 1 GENERAL

1.1 REFERENCES

Not Used.

1.2 SUBMITTALS

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

SD-01 Data

Finishes; GA. Accessory Items; GA.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, fasteners proposed for use for each type of wall construction, mounting instructions, operation instructions, and cleaning instructions.

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.

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 MANUFACTURED UNITS

Toilet accessories shall be provided where indicated in accordance with paragraph SCHEDULE. Each accessory item shall be complete with the necessary mounting plates and shall be of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Anchors and fasteners shall be capable of developing a restraining force commensurate with the strength of the accessory to be mounted and shall be suited for use with the supporting construction. Exposed fasteners shall be of tamperproof design and shall be finished to match the accessory.

2.1.2 Finishes

Except where noted otherwise, finishes on metal shall be provided as follows:

| Metal | Finish |
|--|-------------------------|
| _____ | _____ |
| Stainless steel | No. 4 satin finish |
| Carbon steel, copper alloy, and brass | Chromium plated, bright |

2.2 ACCESSORY ITEMS

Accessory items shall conform to the requirements specified below.

2.2.1 Grab Bar (GB)

Grab bar shall be 18 gauge, 1-1/4 inches OD Type 304 stainless steel. Grab bar shall be form and length as indicated. Concealed mounting flange shall have mounting holes concealed. Grab bar shall have satin finish. Installed bars shall be capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Space between wall and grab bar shall be 1-1/2 inch.

2.2.2 Mirrors, Glass (M1)

2.2.2.1 Mirrors

1/4" thick, No. 1 (mirror glazing) quality, clean polished plate/float mirror glass electrolytically copper plated, guaranteed against silver spoilage for 15 years.

2.2.2.2 Backing

Backing shall be resilient, non-absorbent filler material, with not less than 22 ga. galvanized steel backing plate attached to frame with concealed screws, one-piece construction, full height and width of mirror frame. Corrugated cardboard or other moisture absorbent filler material is not acceptable.

2.2.2.3 Hanger

Construct metal backing with hanger slots for concealed "tamper-proof" mounting. Provide manufacturer's standard hanger to engage with backing for concealed installation.

2.2.2.4 Frames

Use one piece roll formed frames, not less than 22 ga., satin finish, type 304 stainless steel, with square corners heli-arc welded and ground smooth.

2.2.2.5 Mirrors without Shelf

Provide of size as designated, 30-inch height; Bobrick B-290 series.

2.2.3 Sanitary Napkin Disposer (SND)

Sanitary napkin disposal shall be constructed of Type 304 stainless steel with removable leak-proof receptacle for disposable liners. Fifty disposable liners of the type standard with the manufacturer shall be provided. Receptacle shall be retained in cabinet by tumbler lock. Disposer shall be provided with a door for inserting disposed napkins, and shall be surface mounted.

2.2.4 Soap Dispenser (SD)

Soap dispenser shall be surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 40 fluid ounces with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

2.2.5 Robe Hook (RH)

Robe hook shall have concealed wall fastenings, and a pin integral with or permanently fastened to wall flange. Maximum projection shall be 4 inches. Design shall be consistent with design of other accessory items. Finish shall be bright polish.

2.2.6 Toilet Paper Holder (TP)

Surface mounted, double roll without controlled delivery.

2.2.7 Mop and Broom Holder (MH)

Satin finish stainless steel, with 3 anti-slip holders with spring loaded rubber cam, 24".

2.2.8 Diaper Changing Station (CS)

Diaper changing station shall be surface mounted and shall be fabricated of high impact plastic with no sharp edges. Unit fold down platform shall be concave to the child's shape, equipped with nylon and velcro safety straps and engineered to withstand a minimum static load of 250 lb. Safety graphics shall be pictorial for universal use. Color shall be selected by the Contracting Officer from manufacturer's standard colors.

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 CLEANING

Material shall be cleaned in accordance with manufacturer's recommendations. Alkaline or abrasive agents shall not be used. Precautions shall be taken to avoid scratching or marring of surfaces.

3.3 SCHEDULE

Refer to drawings for schedule.

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SECTION 14630

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SECTION 14630

ELECTRICAL OVERHEAD MONORAIL HOIST AND BEAMS

04/01

PART 1 GENERAL

1.1 SCOPE

The work under this section includes the furnishing, fabricating, installation, and testing of the electric overhead monorail system.

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 GEAR MANUFACTURERS ASSOCIATION (AGMA)

| | |
|-------------|---|
| AGMA 6010-E | (1988; Errata Nov 91) Standard for Spur, Helical, Herringbone and Bevel Enclosed Drives |
| AGMA 6019-E | (1989) Gearmotors Using Spur, Helical, Herringbone, Straight Bevel, or Spiral Bevel Gears |
| AGMA 6021-E | (1989) Shaft Mounted and Screw Conveyor Drives Using Spur, Helical and Herringbone Gears |

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (ASIC)

| | |
|-----------|---|
| ASIC S329 | (1985) Allowable Stress Design Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts |
|-----------|---|

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|------------|---|
| ASTM A 159 | (1983; R 1993) Automotive Gray Iron Castings |
| ASTM A 325 | (1996) Structural Bolts, Steel Heat Treated, 120/105 ksi Minimum Tensile Strength |
| ASTM A 490 | (1997) Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum |

Tensile Strength

| | |
|------------|---|
| ASTM A 668 | (1996) Steel Forgings, Carbon and Alloy, for General Industrial Use |
| ASTM B 438 | (1995) Sintered Bronze Bearings (Oil-Impregnated) |
| ASTM B 439 | (1995) Iron-Base Sintered Bearings (Oil-Impregnated) |
| ASTM B 612 | (1996) Iron Bronze Sintered Bearings (Oil-Impregnated) |
| ASTM B 633 | (1985) Electrodeposited Coatings of Zinc on Iron and Steel |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

| | |
|-------------|--|
| ASME B30.16 | (1993) Overhead Hoist (Underhung) |
| ASME B30.17 | (1992) Overhead and Gantry Cranes Top Running Bridge, Single Girder, Underhung Hoist |

AMERICAN WELDING SOCIETY (AWS)

| | |
|-----------|--|
| AWS D1.1 | (1996) Structural Welding Code-Steel |
| AWS D14.1 | (1985) Welding of Industrial and Mill Cranes and Other Material Handling Equipment |

CRANE MANUFACTURERS ASSOCIATION OF AMERICA (CMAA).

| | |
|---------|---|
| CMAA 74 | (1987) Specification for Top Running and Under Running Single Girder Electric Overhead Traveling Cranes |
|---------|---|

MONORAIL MANUFACTURER'S ASSOCIATION (MMA)

| | |
|-----|---|
| MMA | Specification for Underhung Cranes and Monorail Systems |
|-----|---|

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

| | |
|------------|--|
| NEMA ICS 2 | (1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays |
| NEMA ICS 6 | (1993) Enclosures for Industrial Controls and Systems |
| NEMA MG 1 | (1993) Motors and Generator Standards |

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1996) National Electrical Code

UNDERWRITER'S LABORATORIES, INC. (UL)

UL 489 (1991) Molded-Case Circuit Breakers and
Circuit Breaker EnclosuresUL 1004 (1994) UL Standard for Safety Electric
MotorsUL 1449 (1985/1986 Errata) Surge Suppressors,
Transient Voltage

1.3 SUBMITTALS

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

SD-01 Data

Design Calculations; GA.

Design calculations for the selection of the monorail support beams, and connections, and any and all other components of the crane system shall be submitted. Design calculations shall be stamped by a Registered Professional Engineer.

Spare Parts Data; GA.

After approval of the shop drawings and not later than one month prior to the date of beneficial occupancy, the Contractor shall furnish spare parts data for the hoist. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Shop Drawings; GA.

Shop drawings shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature; performance charts and curves; catalog cuts; and installation instructions. Shop drawings shall also contain wiring and schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances. Drawings shall show equipment relationship to other parts of the work, including the pump stations. Clearances for maintenance and operation shall be shown. Shop drawings shall consist of the following:

- a. Complete list of equipment and materials, including manufacturer's descriptive and technical literature; performance charts and curves; catalog cuts; and installation instructions.
- b. Complete wiring and schematic diagrams, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.
- c. Proposed layout and anchorage of equipment and appurtenances.
- d. Equipment relationship to other parts of the work, including the pump station building. Clearances for maintenance and operation shall be shown.

Specific shop drawings shall include the following:

- a. Layout drawing of the monorail crane girder and support beam members.
- b. Wire Rope hoist. Include dimensional data, performance data, and load rating criteria. Include wiring drawings, electric schematics, and electrical installation details.
- c. Cable Reel. The cable reel and pivot support shall be submitted with plan and elevation shown in layout drawing, described in (a.) above, with the cable reel limits of travel, vertical and horizontal tracking and required structural base to achieve operation in one horizontal plane.

SD-09 Reports

Performance Test Reports; GA.

Upon completion and testing of the installed system, test reports shall be submitted 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. The report shall include the information as required by paragraph: ACCEPTANCE TESTING.

SD-19 Operation and Maintenance Manuals

Operation and Maintenance Instructions; GA.

Furnish eight copies of complete operating instructions outlining the step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, part lists, and brief description of all equipment and their basic operating features. Operating instructions shall include all approved shop drawings. Final performance test reports shall be included.

Furnish eight copies of complete maintenance instructions listing routine maintenance procedures, possible breakdowns, repairs, and a trouble-shooting guide. The instructions shall include equipment layout, simplified wiring, and control diagrams for the system as installed.

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams, and posted beside the diagrams. Proposed diagrams, instructions, and other sheets shall be submitted prior to posting. The framed instructions shall be posted before acceptance testing of the systems.

PART 2 PRODUCTS

2.1 GENERAL

2.1.1 Single Responsibility and Standard Products

All work furnished under this section shall be provided by a single supplier who shall take the complete responsibility for the complete package furnished. Materials and equipment shall be standard products of manufacturers regularly engaged in the fabrication of hoists and monorails and shall essentially duplicate items that have been in satisfactory use for at least two years prior to bid opening. Monorail hoist to be supplied shall be designed and manufactured by a company with a minimum of 10 years of specialized experience in this particular field.

2.1.2 Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or catalog number, and serial number on a plate secured to the equipment.

2.1.3 Verification of Dimensions

The Contractor shall verify all dimensions in the field by measurement and shall advise the Contracting Officer of any discrepancy with contract documents before performing any work.

2.1.4 Welding

Welding shall be in accordance with qualified procedures using AWS D14.1 and D1.1, as modified herein. All welding shall be performed indoors, and the surface of parts to be welded shall be free from rust, scale, paint, grease, or other foreign matter. Minimum preheat and interpass temperatures shall conform to the requirements of AWS D1.1. Welding shall be performed in accordance with written procedures that specify the Contractor's standard dimensional tolerances for deviation from camber and sweep. Such tolerances shall not exceed those specified in accordance with AWS D1.1. Allowable stress ranges shall be in accordance with MMA specification. Welding of beam shall conform with AWS D1.1. Welders, welding operators, and welding procedures shall be qualified or prequalified in accordance with AWS D1.1, in lieu of AWS D14.1.

2.1.5 Manufacturer's Services

Services of a manufacturer's representative who is experienced in the installation, adjustment, erection, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

2.1.6 Delivery and Storage

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

2.1.7 Design Criteria

The hoist and trolley shall be designed to operate in the space indicated. The hook vertical travel shall not be less than 8 inches above the station sump floor. The hoist and trolley shall be designed and constructed for moderate service requirements for operation in nonhazardous environment. The hoist shall be 3 ton capacity. Monorail hoist shall be underhung on the monorail beam system. Monorail beam shall be underhung and attached and installed to the support beams as shown on the drawings. The trolley shall be low headroom type and shall be electrically operated motor drive type.

2.1.7.1 Beams

Monorail beam and support members are indicated on the drawings. The crane manufacturer shall design all components of the monorail including the curved monorail beams and support connections to perform with the other hoist support components. The hoist manufacturer shall establish the final size for the monorail beam. Monorail beam shall be underhung from the support beams.

The support beams and connections shall be fabricated from structural steel in accordance with the requirements for structural steel found in SECTION 05500: MISCELLANEOUS METALS, except that the structural steel shall be painted in accordance with these specification instead of galvanized.

2.1.7.2 Rated Capacity and Speeds

The rated capacity of the hoist and trolley shall be 3 tons. The lower load block and hook shall not be considered part of the rated capacity. Rated speed (in feet per minute, fpm) for the hoist shall be as follows.

| | Rated Speeds (fpm) | |
|-------------------|--------------------|---------|
| | Maximum | Minimum |
| Hoist (2 Speed) | 15 | 4 |
| Trolley (2 Speed) | 80 | 20 |

2.1.7.3 Capacity Plate

Two capacity plates shall be provided, one for each side of the hoist. Each plate shall be lettered to indicate the total rated hoisting capacity. All lettering shall be of sufficient size to be easily read from the floor.

The lower load block shall be marked with the hoist-rated capacity.

2.2 MATERIALS

2.2.1 Structural Materials

2.2.1.1 Bolts, Nuts, and Washers

Bolts, nuts, and washers shall conform to ASTM A 325 bolts. High-strength bolted connections shall conform to the requirements of the ASIC Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts, except that ASTM A 490 bolts shall not be used. No galvanized bolts shall be used.

2.2.1.2 Hoist Trolley Frame

Trolley frame shall consist of two structural steel side frames or trucks welded together with one or more structural steel load girts to form a one-piece unit. Pads shall be provided for the use of jacks or wedges when changing truck wheels. Trolley shall be geared, motor driven. Trolley wheels shall ride on sealed roller bearings, and capable of operating on a 5 foot radius.

2.2.1.3 Stops and Bumpers

Structural trolley stops shall be provided on the beam to engage the trolley wheels. Stops shall be located to permit maximum trolley travel.

2.3 HOIST AND TROLLEY

2.3.1 General

Hoist shall be heavy duty, electric, wire rope type. Hoist and trolley shall be furnished by the same supplier. Hoist shall be completely factory assembled. Hoist and trolley shall be rated at 3 tons capacity. Trolley for the hoist shall be motor driven. Monorail beam shall be underhung, from the support beams.

2.3.2 Hoist Load Block

Load block shall be of steel construction. Load block shall be provided with swivel mounting for the hook. Sheave bearing lubrication fittings shall be recessed within the sheave pin or adequately guarded to prevent damage.

2.3.3 Hook Assembly

Hook shall be single barbed and shall be made of forged steel complying with ASTM A 668. Hooks shall be fitted with safety latch designed to preclude inadvertent displacement of slings from the hook saddle. No painting or welding shall be performed on the hook. Hook material and any heat treatment performed shall be stamped on the hook shank or documented in certification papers furnished with the hook. Hook shall be commercially rated and shall have a minimum proof load of twice the safe working load

and a minimum straightening load of four times the safe working load.

2.3.4 Hoisting Ropes

Hoisting ropes shall be regular lay, preformed, uncoated, improved plow steel, 6 by 37 construction, with independent wire rope core. Wire rope shall be designed for hoisting service. The hoisting ropes shall be selected such that the rated capacity load, plus the load block weight, divided by the number of parts of rope, shall not exceed 20 percent of the certified breaking strength of the rope. Hoisting ropes shall be secured to the hoist drum so that no less than two wraps of rope remain at each anchorage of the hoist drum at the extreme low position (limit switch stop).

2.3.5 Sheaves

Sheaves shall be of cast steel, forged, rolled, or welded structural steel. Sheave grooves shall be accurately machined, smoothly finished, and free of surface defects.

2.3.6 Hoist Drum

Hoist drum shall be of welded rolled structural steel, cast steel, or seamless steel pipe. Drum shall be machined and provided with right- and left-hand grooves, including two dead grooves at each of the two anchor points, as may be applicable.

2.3.7 Gearing

Gearing shall be of the enclosed type and shall be an integral part of the hoist. The gears and pinions shall be spur, helical, or herring-bone type only and shall be forged, cast, or rolled steel, except that drum gears may be of welded construction.

2.3.8 Gear Reducers

Gear reducers shall be an integral part of the hoist. Gear reducers shall be designed, manufactured, and rated in accordance with AGMA 6010-E, AGMA 6019-E, or AGMA 6021-E (for trolley drives only), as applicable.

2.3.9 Brakes.

Brakes shall be of the shoe or disk type with thermal capacity suitable for Class C service. Shoe and disk brakes shall be spring set and electrically released by a continuously rated, direct-acting magnet. All brakes shall be self-aligning and provide for easy adjustment for torque setting and lining wear. Brake wheels shall be cast iron conforming to ASTM A 159 or shall be the manufacturer's standard high-strength ductile cast iron, provided that the material exhibits wear characteristics in the form of powdered wear particles and is resistant to heat checking. Disk brakes shall be totally enclosed and have multiple disks with stationary releasing magnets. Brake torque shall be easily adjustable over a 2:1 torque range

2.3.9.1 Hoist Holding Brakes

The hoist shall be equipped with at least one holding brake. The holding brake shall be a friction brake of the shoe design and shall be applied to the motor shaft or to the gear reducer shaft.

2.3.9.2 Hoist Control Brake

Hoist shall be equipped with an integral mechanical load brake of the "Weston" type or multiple-disk type. The multiple disk type brake shall be provided with external adjustment for wear.

2.3.10 Bearings

All bearings, except those subject only to small rocker motion, shall be of the antifriction type. Equalizer sheaves shall be equipped with sintered oil-impregnated type bushings in accordance with ASTM B 438, ASTM B 439, or ASTM B 612.

2.3.11 Antidrip Provisions

The hoist and trolley shall be designed to preclude leakage of lubricants onto the lifted loads or the floor. Equipment and components that cannot be made leakproof shall be fitted with suitable drip pans. The drip pans shall be made of steel and shall be designed to permit removal of the collected lubricant.

2.3.12 Lubrication System

Splash type oil lubrication system shall be provided for the hoist and trolley gear cases. Oil pumps shall be of the reversible type capable of maintaining the same oil flow direction and volume while being driven in either direction. Electric motor-driven pumps may be used when the input shaft speed is too low at any operating condition to ensure adequate oil flow. In such applications, the pump shall be energized whenever the drive mechanism brakes are released.

2.3.13 Electrical Components

Controls, starters, and disconnects shall be furnished with the hoist. Controls shall be integral with the hoist and include heavy duty reversing contactors and low voltage transformer.

2.3.13.1 Hoist Control System.

A four push-button station shall be furnished for the hoist

2.3.13.2 Power Sources

Hoist shall be designed to operate from a 480 volt, three-phase, three-wire, 60 hertz power source.

2.3.13.3 Transformers

Transformers shall be dry-type and shall carry full load continuously at

rated voltage and frequency without exceeding an average temperature rise of 115 degrees C above an ambient temperature of 40 degrees C. The transformer shall have a totally enclosed case, which shall be finished to resist corrosion. Transformers shall be fully encapsulated, except for those specifically designed for use as an isolation transformer for static power conversion units.

2.3.13.4 Motors

Motors shall be designed specifically for crane and hoist duty. Drain holes shall be provided at low points near each end. Inspection and service covers shall be provided with gaskets. All hardware shall be corrosion-resistant. Motors shall conform to the requirements of NFPA 70, NEMA MG 1, and UL 1004.

2.3.13.5 Hoist Motor

The hoist motor shall be industrial-type, two-speed, 4 horsepower rating. If the supplier elects to provide a larger motor, the Contractor shall be responsible for increasing power source wiring, as may be required, at no additional cost to the Government. The hoist motors shall be provided with Class B insulation, with a 30-minute minimum motor time rating to satisfy NEMA permissible motor temperature rise above 40 C ambient.

2.3.13.6 Control System

Controllers shall be provided for the motors. Overload protection shall be in conformance with the requirements of NEMA ICS 2. Contacts used for starting, stopping, and reversing shall be mechanically and electrically interlocked.

2.3.13.7 Control Panel

Control panel shall be fabricated of solid sheet steel designed and constructed to conform to the requirements of NEMA ICS 6, Type 12. Control panel doors shall be hinged, equipped with gaskets, and fitted with key-lock handles designed to latch the door at top, center, and bottom. A single key shall open all locks. The control panel shall be mounted on the hoist and shall contain all starters, transformers, and circuit protection. Disconnect shall be furnished with the hoist for installation by the electrical sub-contractor.

2.3.13.8 Hoist Control

The hoist motor control system shall provide one speed in each direction by means of an electrically operated, full-magnetic, across-the-line, reversing-type starter, NEMA Size 1 minimum.

2.3.13.9 Pendant Control Station

The pendant control station shall be suspended from the hoist by a strain chain or 1/4 inch (minimum) wire rope strain lead of corrosion-resistant steel. The pendant control station enclosure shall be NEMA Type 4/12.

Push buttons shall be heavy-duty, dust-tight and oil-tight type having distinctly felt operating positions. Push buttons shall be constructed so that they cannot become hung-up in the control case. Pendant shall include a separate set of push buttons for each motion and for POWER, ON-POWER, OFF. Pendant shall reach within 4 feet of the operating floor.

a. Push buttons shall be as follows:

| | |
|------------|-------------------|
| Hoist Up | Trolley - Forward |
| Hoist Down | Trolley - Reverse |
| POWER OFF | Power - Off |
| POWER ON | Power - On |

b. The POWER OFF push button shall have a bright red mushroom head.

2.3.13.10 Surge Protection

Three metal oxide varistors shall be provided on the line-side of each transformer to provide transient overvoltage protection. Surge suppressors shall meet the requirements of UL 1449.

2.3.13.11 Overloads

AC circuit overload relays shall be of the ambient-compensated, automatic-reset, inverse-time type located in each phases of the mainline and individual motor circuits and arranged to open the mainline contact.

2.3.13.12 Limit Switches

Limit switches shall be heavy-duty, quick-break, double-pole, double-throw type and shall conform to NEMA ICS 2. Geared limit switch interruption of a motion in one direction shall not prevent the opposite motion. Geared limit switches shall reset automatically. Limit switch housings shall be NEMA Type 12 or 13. Limit switches shall interrupt power to the primary control systems.

2.3.13.13 Hoist Upper Limit Switches

Two limit switches shall be provided for the hoist. A rotating-type, adjustable, geared-control, circuit-interrupt limit switch shall provide hoist-up limiting. A secondary hoist upper limit shall be provided with a weight-operated limit switch to prevent raising beyond their safe limit. This secondary limit switch shall operate to interrupt power to all hoist motor conductors and set the hoist holding brakes.

2.3.13.14 Hoist Lower Limit Switches

Hoists shall be provided with a rotating-type, adjustable, geared-control, circuit-interrupt limit switch for hoist-down travel limiting.

2.3.13.15 Wiring

All wire runs shall be numbered or tagged at connection points. All splices

shall be made in boxes or panels at terminals. Motor loop and branch circuit and brake conductor selection shall be based on the continuous duty rating of NFPA 70 for 60 C conductors, and all other conductors shall be selected based on their 60-minute, short-time rating. Insulation for wiring shall be 600-volt, Type MTW. Conductors in the vicinity of, or connected to, resistors shall be Type TFE. All control wiring shall be 16 AWG or larger. All power wiring shall be 12 AWG or larger.

2.4 CABLE REEL

The Contractor shall furnish a cable reel for supplying power to each monorail hoist. At each pump station, the cable reel shall be located and mounted to the support member spanning the station width from the rear station wall between the first and second pump bay and terminating near the passage door. The beam shall have a spacer of light gage structural steel to align the cable reel guide arm centerline with the monorail hoist horizontal centerline.

2.4.1 Swivel Base

The cable reel shall be mounted on a swivel base capable of 340 degrees of rotation and utilizing sealed ball bearings for smoothness of rotation. The pivot base shall be similar or equal to Insul 8 Model #PVB as manufacturer by Insul 8, Omaha, Nebraska.

2.4.2 Electrical Cable

The reel shall be furnished with 25 feet of electrical type SO cable that supplies power to control panel on the monorail hoist. The cable shall be flexible and suitable in a temperature range from 20 degrees F. to 100 degrees F. The wire size shall be sufficiently large to provide for all hoist and trolley current loads without excessive voltage drop. The connection at the monorail control panel shall allow full travel of the monorail hoist through 340 degrees action of the swivel base. The cable reel shall have positive take-up of slack cable and release of cable using ratchets and springs to control movement. The cable reel shall utilize a slip ring assembly in a NEMA 4X enclosure. A guide arm will control cable direction within 15 degrees and have cable rollers for non-chafing take-up and release of the cable. The return spring shall have sufficient tension to prevent cable droop between the reel and monorail hoist. The stand and reel shall be formed steel construction. Cable reel shall be similar or equal to 1400 Series of Insul 8 Powereel as manufactured by Insul 8 Omaha, Nebraska.

PART 3 EXECUTION

3.1 ERECTION

3.1.1 General

Erection of the monorail hoist and support girders shall be in accordance with the manufacturer's instructions and as indicated. Major components of the hoist and trolley shall be shop assembled as completely as possible.

After complete shop testing, disassembled parts shall be match-marked and electrical connections shall be tagged. All parts and equipment at the site shall be protected from weather, damage, abuse, and loss of identification. The erection procedures shall ensure that the hoist and trolley are erected without initial stresses, forced or improvised fits, misalignments, nicks of high-strength structural steel components, stress-raising welds, and rough burrs. After the hoist and trolley are erected, any damaged painted surfaces shall be cleaned and repainted. All couplings, brakes, gearboxes, and drive components shall be aligned when reinstalled, in accordance with manufacturer's instructions.

3.1.2 Installation of Girders

Support girders and beams shall be straight and true. When loaded, the deflection of hoist beam shall not exceed 1/800 of the span. Monorail joints shall be flush and true without misalignment of running tread and shall be designed to minimize vibration. The monorail beam shall be leveled to a plus-or-minus 3 mm (1/8 inch) at all rail support joints. Rail joints shall be bolted using standard joint bars. A positive stop shall be provided at monorail beam ends.

3.1.3 Painting

Monorail beam, support beams and connections, and all other components of the monorail hoist, shall be painted. Contractor shall submit paint system for approval. As a minimum, 2 primer coats and 2 finish coats shall be applied. Finish coat shall be enamel or epoxy. Monorail hoist and trolley shall be painted per the manufacturer's standard finish. Items such as surfaces in contact with the rail wheels, wheel tread, hooks, and wire rope and nameplates shall not be painted.

3.1.4 Electrical Installation.

The electrical system shall be installed in accordance with manufacturer's instructions. All controls, starters, and disconnects shall be furnished with the hoist. Alignment data shall include timer settings, resistor tap settings, potentiometer settings, test point voltages, supply voltages, motor voltages, motor currents, and test conditions, such as ambient temperature, motor load, date performed, and person performing the alignment. A copy of the final alignment data shall be stored in the control panel door. Electrical hookup shall be in accordance with SECTION: ELECTRICAL WORK.

3.2 ACCEPTANCE TESTING

The date of this template is 15 June 1999. This template will be updated from time-to-time to reflect current requirements.

3.2.1 Monorail hoist and Acceptance Test

The Contractor shall provide all personnel and equipment necessary to conduct the tests, including, but not limited to, hoist operators, riggers, rigging gear, and test weights. Testing shall be performed in the presence of Contracting Officer. The Contractor shall notify the Contracting

Officer 15 days prior to testing operations.

3.2.2 Test Sequence

The hoist shall be tested according to the applicable paragraphs of this procedure in the sequence provided.

3.2.3 Test Data

Hoist test data shall be recorded on appropriate test record forms suitable for retention for the life of the hoist. Operating and startup current measurements shall be recorded for electrical equipment (motors and coils) using appropriate instrumentation. Speed measurements shall be recorded as required by the facility evaluation tests (normally at 100 percent load). Recorded values shall be compared with design specifications or manufacturer's recommended values; abnormal differences shall be justified in the remarks or appropriate adjustments performed. In addition, high temperatures or abnormal operation of any equipment or machinery shall be noted, investigated, and corrected. Hoist speeds should be recorded during each test cycle.

3.2.4 Equipment Monitoring

During the load test, improper operation or poor condition of safety devices, electrical components, mechanical equipment, and structural assemblies shall be monitored. Observed defects critical to continued testing shall be reported immediately to the Contracting Officer, and testing shall be suspended until the deficiency is corrected. During and immediately following each load test, the following inspections shall be made:

- a. Inspect for evidence of bending, warping, permanent deformation, cracking, or malfunction of structural components.
- b. Inspect for evidence of slippage in wire rope sockets and fittings.
- c. Check for overheating in brake operation; check for proper stopping. All safety devices, including emergency stop switches and POWER OFF push buttons, shall be tested and inspected separately to verify proper operation of the brakes.
- d. Check for abnormal noise or vibration and overheating in machinery drive components.
- e. Check wire rope sheaves and drum spooling for proper operation, freedom of movement, abnormal noise, or vibration.
- f. Check electrical drive components for proper operation, freedom from chatter, noise, or overheating.
- g. Inspect external gears for abnormal wear patterns, damage, or inadequate lubrication.

3.2.5 Hooks

Hooks shall be measured for hook throat spread before and after load test. A throat dimension base measurement shall be established by installing two tram points and measuring the distance between these tram points (to within 1/64 inch). This base dimension shall be recorded. The distance between tram points shall be measured before and after load test. An increase in the throat opening by more than 1 percent from the base measurement shall be cause for rejection.

3.2.6 No-Load Testing

3.2.6.1 Hoist and Limit Switch Test

The load hook shall be raised and lowered through the full range of normal travel at rated speed. The load hook shall be stopped below the geared limit switch upper setting. Proper operation of upper and lower limit switches for primary motions shall be verified. The test shall be repeated a sufficient number of times (minimum of three) to demonstrate proper operation. Brake action shall be tested in each direction. The proper time delay shall be verified between the actuation of the dual brakes.

3.2.6.2 Trolley Travel

The monorail trolley shall be operated the full distance of the monorail beams including operating over the curved sections. The trolley bumpers shall contact the trolley stops located on the monorail beams. The hoist trolley shall be operated across the full length of the monorail beam.

3.2.6.3 Hoist Loss of Power No-Load Test

Using primary drive, the hook shall be raised to a height of approximately 8 feet. While lowering the hook, the main power source shall be disconnected verifying that the hook will not lower and that both brakes will set.

3.2.7 Load Test

Unless otherwise indicated, the following tests shall be performed using a test load of 125 percent (plus 5 percent, minus 0 percent) of rated load

3.2.7.1 Hoist Static Load Test

Holding brakes and hoisting components shall be tested by raising the test load approximately 1 foot and manually releasing one of the holding brakes. The load shall be held for 10 minutes. The first holding brake shall be reapplied, and the second holding brake shall be released. The load shall be held for 10 minutes. Any lowering that may occur indicates a malfunction of the brakes or lowering components.

3.2.7.2 Dynamic Load Test

The test load shall be raised and lowered through the full range. The machinery shall be completely stopped at least once in each direction to

ensure proper brake operation.

3.2.7.3 Hoist Load Brake

With test load raised approximately 5 feet and with the hoist controller in the neutral position, the holding brake shall be released. The load brake shall be capable of holding the test load. With the holding brake in the released position, the test load shall be lowered (first point) and the controller shall be returned to OFF position as the test load lowers. The load brake shall prevent the test load from accelerating.

3.2.7.4 Hoist Loss of Power Test

After raising the test load to approximately 8 feet and slowly lowering the test load, the main power source and the control push button shall be released verifying that the test load will not lower and that both brakes will set.

3.2.7.5 Beam Dynamic Load Test

Operate the hoist trolley the full distance of the monorail beam in each direction with test load on the hook (one cycle). Confirm that no permanent deflections have occurred and no fasteners have loosened. Operate the monorail hoist the full distance along the monorail beams with test load on the hook.

3.2.8 Pump Lifting Test

After successful completion of the load test using test weights, the hoist shall be used to lift the pumps out of the wetwell. The lifting of both pumps shall be demonstrated. Pumps shall be lifted completely out of the wet well and set on the floor of the pump station.

3.3 FIELD TRAINING

A field training course shall be provided for designated operating staff members. Training shall be provided for a total period of two 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 the items contained in the operating and maintenance instructions.

-- End of Section --

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SECTION 15000

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SECTION 15000

POWER GENERATION EQUIPMENT

04/01

PART 1 GENERAL

1.1 SCOPE

This section covers the furnishing and installing of the necessary ductwork, exhaust system, electrical connections, and any other power distribution equipment as shown and specified herein to complete the installation of Government Furnished Generators for all five pumps stations as indicated on the drawings. The handling, installing, connecting and testing of these Government-furnished generators, connection to the electrical distribution system, the standby generator cooling removal system, engine exhaust and other associated equipment including installation of the GFE automatic transfer switch, are also part of the Contractor's work under this section. The load bank specified herein shall be furnished and installed by the Contractor.

1.2 RELATED WORK OF OTHER SECTIONS

The following items of related work are covered under other Sections:

- (1) Painting: SECTION: 09900: PAINTING, GENERAL.
- (2) Government-furnished equipment: SECTION 01000: GENERAL.
- (3) Grounding and Bonding: SECTION 16415: ELECTRICAL WORK, INTERIOR.
- (4) Louvers, dampers and ductwork: SECTION 15500 HEATING AND VENTILATING SYSTEMS.

1.3 REFERENCES

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

American National Standards Institute (ANSI)

ANSI C2 (1997) National Electrical Safety Code

National Electrical Manufacturers Association (NEMA)

NEMA AB 1 (1993) Molded Case Circuit Breakers and
Molded Case Switches

NEMA ICS 1 (1993) Industrial Control and Systems

| | |
|---|--|
| NEMA ICS 2 | (1993) Industrial Control Devices, Controllers and Assemblies |
| NEMA ICS 3 | (1993) Industrial Systems |
| NEMA ICS 4 | (1993) Industrial Control and Systems Terminal Blocks |
| National Fire Protection Association (NFPA) | |
| NFPA 70 | (1996) National Electrical Code |
| Underwriters Laboratories, Inc. (UL) | |
| UL 03 | (1996) Electrical Construction Materials Directory (with Quarterly Supplements) |
| UL 67 | (1993) Panelboards |
| UL 98 | (1994, Rev Feb,1995) Enclosed and Dead-Front Switches |
| UL 198C | (1986; Rev thru Jun 1993) High-Interrupting-Capacity Fuses, Current-Limiting Types |
| UL 198H | (1988; Rev thru Nov 1993) Class T Fuses |
| UL 467 | (1993) Grounding and Bonding Equipment |
| UL 489 | (1996; Rev May 1997) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures |
| UL 506 | (1994; Rev Jul 1994) Specialty Transformers |
| UL 508 | (1993) Industrial Control Equipment |
| UL 845 | (1995) Motor Control Centers |
| 869A | (1993; Rev Apr 1994) Reference Standard for Service Equipment |
| UL 891 | (1994; Rev thru Jan 1995) Dead-Front Switchboards |
| UL 943 | (1993; Rev thru Jan 1995) Ground-Fault Circuit Interrupters |

1.4 SUBMITTALS

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

following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-04 Drawings

Equipment and Materials Shop Drawings; GA.

Shop drawings shall be submitted for approval and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical data; catalog cuts; and any special installation instructions that may be required. Shop drawings shall be submitted for all materials and equipment specified.

SD-04 Drawings

Cooling Air Ductwork Shop Drawings; GA

Cooling air ductwork shop drawings. Drawings shall be prepared that indicate sizes and physical configuration of the louvers, dampers, and ductwork required to connect the GFE generator and load bank into each pump station as shown on the drawings.

SD-01 Data

List of Equipment and MaterialsSD-; FIO

List of Equipment and Materials. A complete list of accessory equipment and materials proposed (such as anchor bolts, exhaust components, etc), containing an adequate description of each separate item of equipment or materials recommended for approval, shall be furnished. The quantity of each item described shall be indicated.

SD-13 Certificates

Equipment and Material Certificates; GA.

Certificates of compliance will be accepted as proof of compliance when equipment or materials are required to conform to UL standards, or to be manufactured and/or tested by NEMA standards. Such certificates are not required if manufacturer's published data submitted and approved reflect a UL listing or conformance with applicable publications of the NEMA. Otherwise, evidence of a UL listing, or conformance with applicable NEMA standards, shall be submitted, as appropriate. Proof of the listing by the UL, or conformance with the applicable publications of the NEMA, does not relieve the Contractor of compliance with other provisions of these specifications.

For other than equipment and materials specified to conform to UL publications, a manufacturer's statement indicating complete compliance with the applicable Federal Specification, or standard of ASTM, NEMA, or other commercial standard, is acceptable.

SD-06 Instructions and SD-19 Operation and Maintenance Manuals

Instruction Manuals; GA.

The instruction manuals shall be furnished to the Government following the completion of factory tests and shall include assembly, installation, operation and maintenance instructions, spare parts data which provide supplier name, current cost, catalog order number, and a recommended list of spare parts to be stocked and documents submitted and approved. Manuals also include data outlining step-by-step procedures for system startup and operation, and a troubleshooting guide which lists possible operational problems and corrective action to be taken. A brief description of all equipment and their basic operating features are also included. Documents are bound in a suitable binder adequately marked or identified on the spine and front cover. A table of contents page has been included and marked with pertinent supply contract information and contents of the manual. Tabs are provided to separate different types of documents, such as catalog ordering information, drawings, instructions, and spare parts data. Index sheets are provided for each section of the manual when warranted by the quantity of documents included under separate tabs or dividers. The Contractor may utilize the two copies for the duration of start-up and testing of generator systems. Instruction Manuals shall be returned to the Government after generator equipment.

SD-04 Drawings

Exhaust System Drawings; GA

Exhaust System from muffler outlet. Shop drawings shall be provided that indicate the pipe layout, materials, hangers, roof thimble, drip leg, and beveled exhaust elbow. The drawings shall indicate exhaust pipe route to avoid interference with the monorail hoist and cable reel system.

PART 2 PRODUCTS

2.1 GENERAL

2.1.1 Standard Product

Material and equipment utilized in the installation shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 5 years prior to bid opening. The experience use shall include applications of equipment and materials under similar circumstances and of the same design and rating as the equipment specified.

2.1.2 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Unless otherwise specified, all identification nameplates shall be made of laminated plastic in accordance with Fed. Spec. L-P-387 with black outer layers and a white core. Edges shall be chamfered. Plates shall be fastened with black-finished round-head drive screws or approved non-adhesive metal fasteners. When the nameplate is to be installed on an irregular shaped

object, the Contractor shall devise an approved support suitable for the application. In all instances, the nameplate shall be installed in a conspicuous location. At the option of the Contractor, the equipment manufacturer's standard embossed nameplate material with black paint-filled letters may be furnished in lieu of laminated plastic.

2.1.3 Code Compliance

The installation shall comply with the requirements and recommendations of NFPA 70 and ANSI C2.

2.1.4 Coordination

The drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment will be properly located and readily accessible. If any conflict occurs necessitating departures from the drawings, details of and reasons for departures shall be submitted and approved prior to implementing any change.

2.1.5 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy or conflicts before performing any work.

2.2 MATERIALS

2.2.1 Workmanship

Materials and equipment shall be installed in accordance with recommendations of the manufacturer and as shown.

2.2.2 Materials and Equipment

Materials and equipment shall conform to the respective publications and other requirements specified below. Materials and equipment not listed below shall be as specified elsewhere in this section.

2.2.3 Ductwork

All ductwork shall be made from galvanized steel sheets. All ductwork shall comply with SMACNA HVAC Duct Construction Standards. All ductwork shall be substantially airtight with no audible leaks, reinforced or crimped to prevent "panning" at system start-up and good rigid connections to louvers and dampers.

2.2.4 Flexible Connector

The engine-generator shall be connected to the ductwork utilizing a flexible duct connector made of either fiberglass or neoprene strips bound to galvanized metal strips on each side. Duct connector shall be submitted for approval by the Contracting Officer's Representative.

2.2.5 Exhaust Pipe

The exhaust pipe from the muffler outlet to discharge elbow on the end of the exhaust system shall be made of stainless steel. Exhaust pipe shall be furnished between the flexible connector and the muffler in stainless steel.

2.2.6 Load Bank

The Contractor shall furnish a load bank for each engine set installed in each pump station. The load banks shall be sized as follows: Pump Station L-2 & K-7 50 KW, Pump Station L-1 & K-10 100 KW, and Pump Station K-12 125 KW with single step loading at the designated load. The load bank shall be a resistive load cooled by the engine-cooling fan in the engine cooling discharge ductwork. The location of the load bank in the ductwork shall be as recommended by the government furnished engine generator manufacturer and approved by the Contracting Officer's Representative as shown on the shop drawings. The load bank shall be a self-contained unit housed within the ductwork. Supporting members under the ductwork mounted load bank shall be furnished as required. The control panel shall allow for hand/off/automatic operation with the engine generator control system and located as directed by Contracting Officer's Representative. The load bank shall be protected including load rejection should the cooling air of the engine be interrupted. All control and protective circuits shall operate at 120 volts shall be fused and powered from a control power transformer or line-neutral circuit. Main terminals shall be located on a barrier terminal block with compression type terminals and a chassis ground lug or stud shall be provided with a compression type terminal. All power wiring shall be rated for 150 degrees C. insulation. A main disconnecting load rated switch shall be provided to disconnect the load bank when standby power is required at the station. All load elements shall have short circuit protection for each 50 KW of load branch circuit. All load elements shall be UL listed totally enclosed, sealed and weatherproof with a grounded outer sheath to protect against accidental shock from foreign objects or personnel contact damaging the tubes. The elements shall be easily replaceable. The use of open wire elements capable of short circuit to each other or foreign objects shall not be permitted. The load bank and control sections shall be housed in NEMA 1 galvanized steel enclosures. The control enclosure shall be located in the vicinity of the load bank section, but not in contact with the load bank or the cooling airflow. The load bank shall be manufacturer as a standard product with testing and listing by Underwriters Laboratories as a system for electrical load simulation. The load bank shall be similar or equal to Simplex LBD series load banks, as manufactured by Simplex Inc., Springfield IL. 62702 in design and construction of the control and load enclosure.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Layout

The Contractor shall furnish a plan and elevation layout for each pump station that indicates centerline of the skid-mounted generator unit all

anchorage, vibration isolation, engine exhaust components and engine cooling ductwork shown. The location of the load bank between the radiator and damper/louver at the wall shall be shown. The location of the overhead monorail hoist shall also be indicated. All ductwork shall be submitted for approval after the layout is approved.

3.1.2 Exhaust System

The exhaust system shall be installed to avoid interference with the overhead monorail hoist and roof truss system. All exhaust piping shall be insulated to protect occupants from burns or deterioration to adjacent equipment. The 24" long flexible exhaust connector and the muffler shall not be insulated. Final location of all exhaust system components, insulation system shall be submitted for approval.

3.1.3 Field Painting

Ferrous surfaces shall be cleaned and painted. Surfaces to be painted shall be free of all oil, grease, welding slag and spatter, mill scale, deleterious corrosion, dirt and other foreign substances. Painting shall include at least "touch-up" one coat of the generator manufacturer's paint system. If substantial bare metal has been exposed during installation, then a rust-inhibiting primer shall be applied to a clean, dry surface as soon as practicable after cleaning. Painting shall be manufacturer's standard material and process except that the total dry film thickness shall be not less than 2.5 mils. Color of the finish coat may be the manufacturer's standard color, if approved, or an approved ANSI 61 Gray. The finish shall be free from runs, sags, peeling or other defects.

3.1.4 Tests

After each pump station installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct an operating test for approval of the installed engine generator system. The equipment shall be demonstrated to operate in accordance with the installation requirements of this specification. The test shall be performed in the presence of the Contracting Officer and representatives from the City of East Grand Forks. The Contractor shall furnish all instruments and personnel to assist the ONAN representative in conducting the required tests, and the Contractor shall furnish 50 gallons of diesel fuel at pump stations K-7, K-10, L-1, and L-2, and shall furnish 100 gallons of diesel fuel at pump station K-12 for testing purposes. The engine-generator manufacturer under a separate contract will furnish other consumable items, lubricants and coolants. The test performed at pump station K-12 will be unique in that an external portable load bank will be furnished to test the generator set at full load for not less than a 1 hour time period. All requirements of the following paragraphs shall also apply for the test at K-12.

3.1.4.1 Automatic Transfer Switch

The Contractor shall demonstrate that all features of the Government-furnished automatic transfer switch are operational and properly interface with the Government-furnished generator and controls.

3.1.4.2 Louvers and Dampers

The Contractor shall demonstrate the dampers, motorized operators and louvers function correctly for supplying and exhausting air to the engine-generator unit, including testing and balancing of the system. Ambient outside, interior and exhaust air temperatures shall be monitored. Airflow over the louver faces shall be monitored over a minimum 12-point test grid on the louver surface. Temperatures shall continue to be monitored for 30 minutes after shut down. Temperatures and air flows will be measured using calibrated instruments accurate to within +/- 3% of actual readings.

3.1.4.3 Generator

The Contractor shall request from the Contracting Officer's Representative, the services of a ONAN manufacturers authorized field service engineer to supervise the start-up and testing of the Government-furnished generator, its auxiliary equipment and controls. The Contractor shall expect each test at each pump station to last not less than four hours or exceed 8 hours total time including set-up, preparation, test, and clean-up. The Contractor shall request the ONAN services at least fourteen calendar days in advance and group the pump station tests within the same time frame wherein possible. Services of the ONAN representative are provided under a separate contract and are not included in the work required in this contract.

3.2 SPARE PARTS

Spare parts do not apply to Government-furnished equipment.

Provide a complete set of accessories and special tools required to erect, handle, dismantle, test, and maintain electrical system apparatus.

Spare parts shall be identical in all respects to corresponding original equipment provided.

Spare Parts Required. (To be completed after FTR)

One pilot light with lens for each type provided.

One contactor auxiliary contact for each type provided.

3.3 QUALITY CONTROL

The Contractor shall establish and maintain a quality control program for work under this section to assure compliance with contract requirements, and he shall maintain records of his quality control for all construction operations including but not limited to the following:

a. Inspection at worksite for damage and defects in material and equipment.

- b. Inspection at worksite to ensure use of specified material and equipment.
- c. Storage at the worksite.
- d. Installation, mounting and alignment of all equipment.
- e. Operational tests of all installed facilities.
- f. Maintenance after installation.

Two copies of the records of inspections and tests, as well as the records of corrective actions taken, shall be furnished to the Government as directed by the Contracting Officer. The Quality Control Plan shall be in accordance with SECTION 01451: CONTRACTOR QUALITY CONTROL.

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SECTION 15050

SLUICE GATES

04/01

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 29 | (1988) American Association of State Highway and Transportation Officials (AASHTO) |
| AASHTO M 82 | (1975, Rev 1993) Cut-Back Asphalt (Medium Curing Type) |

American Society for Testing and Materials (ASTM)

- | | |
|------------|--|
| ASTM A 36 | (1994) Structural Steel |
| ASTM A 108 | (1993) Steel Bars, Carbon, Cold Finished, Standard Quality |
| ASTM A 126 | (1993) Gray-Iron Castings for Valves, Flanges, and Pipe Fittings |
| ASTM A 148 | (1993) Steel Castings, High-Strength, for Structural Purposes |
| ASTM A 194 | (1994) Carbon and Alloy Steel Nuts for Bolts for High Pressure and High-Temperature Service. |
| ASTM A 276 | (1994) Stainless and Heat-Resisting Steel Bars and Shapes |
| ASTM A 320 | (1994) Alloy-Steel Bolting Materials for Low-Temperature Service |
| ASTM A 582 | (1993) Free-Matching Stainless and Heat-Resisting Steel Bars, Hot-Rolled or Cold-Finished |

| | |
|-------------|--|
| ASTM B 21 | (1990) Naval Brass Rod, Bar and Shapes |
| ASTM B 98 | (1993) Copper-Silicon Alloy Rod, Bar and Shapes |
| ASTM B 584 | (1993) Copper Alloy Sand Castings for General Applications |
| ASTM C 33 | (1997) Specification for Concrete Aggregates |
| ASTM D 2000 | (1990) Rubber Products in Automotive Applications |

American Water Works Association (AWWA)

| | |
|------------|----------------------------------|
| AWWA C 501 | (1992) Standard for Sluice Gates |
|------------|----------------------------------|

1.2 SUBMITTALS

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

SD-01 Data

Design Data; GA.

Design computations and technical data showing factors of safety, calculations of stresses, and other information necessary to assure compliance with the drawings and specifications shall be submitted to the Contracting Officer.

Hoist Design Criteria: The Contractor shall submit calculations which clearly show how the size of the operator was chosen. For the sluice gate lifts, a friction factor of 0.6 shall be used, and the gate size and the heads shall be those specified elsewhere in this section.

SD-01 Data

Gate Vendor Information; FIO

Gate Vendor's Erecting Engineer: Gate vendor information as specified in PARAGRAPH: Gate Vendor's Erecting Engineer, of this section shall be submitted.

SD-04 Drawings

Shop Drawings; GA.

Shop drawings shall be submitted for sluice gates showing details for mounting, materials, construction and installation procedures. Catalog data, including specifications and full descriptive data, shall be

submitted for all materials and equipment furnished. Shop drawings on the portable operator to include catalogue and performance data. Top mounting wall bracket for gravity closure gate installation and support shop drawings shall be submitted.

SD-19 Operation and Maintenance Manuals

Operation and Maintenance Manuals; GA.

The Contractor shall submit, prior to delivery of gates to the project work site, five copies of a manual containing complete information in connection with the operation, lubrication, adjustment, routine and special maintenance, disassembly, repair, and reassembly of the gates and accessories. Each set shall be permanently bound and shall have on the cover the following: (1) The words, "OPERATING AND MAINTENANCE INSTRUCTIONS", (2) the name and location of the project, (3) the Contractor's name, and (4) the contract number. Flysheets shall be placed before instructions covering the subject. The sheets shall be approximately 8-1/2 x 11" which large sheets of drawings folded in. Each set shall include, but not be limited to, the following:

- a. Operating and maintenance instructions for each piece of equipment including lubrication instructions.
- b. Manufacturer's bulletins, cuts, and descriptive data
- c. Parts lists and recommended spare parts.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

Sluice gates shall be the standard product of a reputable manufacturer having had at least 5 years of successful experience in the design and manufacture of such items. Gates and accessories shall be of the following design:

- a. Sluice gates shall be rising stem.
- b. Gates shall be either flush bottom type or wall mounted as indicated on the drawings.
- c. Sluice gate frames shall be flange back type.
- d. Thimbles shall be sufficiently rigid to preclude distortion during installation.

2.1.1 General Design

Component parts shall be designed for the seating and unseating heads shown in TABLE 1 in this section using a minimum factor of safety of 5, to be increased as desired and be sized and guided so that, unless otherwise shown on the drawings, the slenderness ratio (L/R) shall not exceed 200. The opening and closing forces for design of the stem and stem block

anchorage shall include friction load based on the operating pressure shown in TABLE 1, with coefficient of friction of not less than 0.6 for sluice gates in addition to the weight of the gate and stem. Stem design shall include a factor of safety of 5 against failure in addition to the column buckling strength reduction effects as given by the Euler formula.

TABLE 1. GATE REQUIREMENTS

| Gate Location | Gate Size (Inches) | Number of Gates | Face Design Pressure (Feet of Head) | Back Design Pressure (Feet of Head) |
|----------------------|-----------------------|--------------------|---|---|
| L-1 Inlet | 54 x 54 | 1 | 50 | 25 |
| L-1 Gravity Flow | 42 x 42 | 1 | 50 | 25 |
| L-2 Inlet | 42 x 42 | 1 | 50 | 25 |
| L-2 Gravity Flow | 60 x 60 | 1 | 50 | 25 |
| K-7 Inlet | 42 x 42 | 1 | 50 | 25 |
| K-7 Gravity Flow | 54 x 54 | 2 | 50 | 25 |
| K-10 Inlet | 42 x 42 | 1 | 50 | 25 |
| K-10 Gravity Flow | 72 x 72 | 3 | 50 | 25 |
| K-12 Inlet | 66 x 66 | 1 | 50 | 25 |
| K-12 Gravity Flow | 66 x 66 | 2 | 50 | 25 |

2.2 MATERIALS

Materials shall meet the requirements of the following referenced publications. Use of other grades or alloys shall be requested in writing and will be subject to approval.

- a. Structural steel: ASTM A 36.
- b. Naval brass: ASTM B 21, copper alloy No. 464 or 482; temper, optional.
 1. Iron castings: ASTM A 126.
 2. Steel casting: ASTM A 148.
- c. Manganese bronze: ASTM B 584, high-strength yellow brass, copper alloy No. 932.
- d. Cold-rolled steel: ASTM A 108, Grades 1010 through 1020.
- e. Stainless steel:
 1. ASTM A 276, Type 304, Condition A (annealed) or B (cold worked, high tensile), type of finish optional.

2. ASTM A 582, Type 303, Condition A (annealed), type of finish optional.

f. Bolting materials:

1. Bolts: ASTM A 582, Type 303 or 416.

2. Nuts: ASTM B 98, alloy 655.

g. Asphalt liquid: AASHTO M 82, medium-core, liquid-asphalt type, Grade MC-30 or MC-70.

h. Sand: AASHTO M 29.

i. Seals: ASTM D 2000, Grade 4AA 625A13.

2.3 SLUICE GATES

2.3.1 General

Gates shall be heavy-duty type as manufactured by Rodney Hunt, Hydro Gate, Waterman, or approved equal. The sluice gate installations shall be furnished complete with frames, leaves, stems, adjustable stem guides, thimbles and anchor bolts, complete and operable in all respects as described herein and as indicated on the drawings. The gates shall be of the pressure seating type, and shall be designed for the face pressures and back pressures indicated in TABLE 1. The capacities of the operating stands shall be based upon the pressure exerted on the entire area enclosed by the gate sealing surfaces (seating faces). As used herein, operating pressure head is defined as the distance from the center of the slide, in its closed position, to the maximum water surface elevation. Sluice gates designated for power operation shall be sufficiently rugged to withstand operation by means of electric lifts or portable hydraulic operators. Gates used for gravity flow closure in gatewells shall not be considered for alternate fabrication and materials under any circumstances.

2.3.2 Wall Thimbles

Wall thimbles shall be of the F-type. The thimbles shall be of cast iron with the front-flange machined to a plane to provide a true-seating surface for the sluice gate frame. Holes shall be drilled and tapped in the thimble to match the mounting hole pattern of the sluice gate frame. The gate frames shall be attached to the thimble by studs. The wall thimble shall be internally braced during concrete placement. Thimble shall be plumb in both planes with + 1/16 inch. The overall wall thimble length be less than the wall thickness allowing room for an RCP pipe socket behind the thimble.

2.3.3 Frames

The frames shall be cast iron of ample section to prevent distortion. Seat facings shall be naval brass and shall be machined to a smooth finish for making a tight seal meeting the requirements of AWWA C 501. The frame guides shall be of cast iron. The frame guides shall be equipped with

adjustable side wedges, and the guides shall be of sufficient length so that not less than one-half of the gate is within the guides when the gate is wide open. The side wedges shall be faced with manganese bronze. Wedges shall be designed in such a manner that wedge-fastening bolts may be replaced without the removal of the gate frame from the masonry or other setting, and their attachments adequate to resist tight closures of the gates. Gates shall be provided with top wedges. Fabricated stainless steel frames shall not be allowed

2.3.4 Gate Leaves

Gate leaves shall be of cast iron, consisting of flat castings with horizontal and vertical ribs of ample section to withstand all of the specified conditions of operation with limited distortion to prevent leakage. The seating surfaces shall be of naval brass not less than 3/4" wide and shall be machined to a 63 micro-inch finish or better and attached by dovetail notching to make a watertight seal. The gate shall be guided in the frame with a tongue and groove construction. The tongue and grooves shall be machined full length with a 1/8" overall clearance in the frame guide groove. Slide wedges shall be faced with manganese bronze and mounted and secured to prevent rotation that would interfere with their proper action or cause the gate to bind, in addition to meeting the requirements of AWWA C 501. Fabricated gate slides of stainless steel shall not be allowed.

2.3.5 Stems

The stems shall be of stainless steel conforming to ASTM A 276, Type 302, 303, 304 with a 63 micro-inch finish if machine cut or 32 micro-inch if rolled threads, and shall be of the sizes recommended by the manufacturer. No detectable flaws or surface imperfections will be permitted. The stems shall be provided with thrust nuts of corrosion-resisting metal and shall have adjustable stop nuts to limit the upward and downward travel of the stems. The stems shall be of a size to withstand the axial compressive and tensile forces created during gate operation under the specified unbalanced heads and to transmit in compression at least two times the rated output of the lift with a 25-pound effort on the crank or handwheel. Threads on stems shall be machine cut or rolled with single or double lead threads of the Acme type. The exterior corners of the threads shall be given slight radius of approximately 0.015" in order to prevent them from acting as cutting edges as the stem passes through the left nut.

2.3.6 Stem Guides

Stem guides shall be a manufacturer's standard product, except as specified provided herein, and shall be adjustable in two directions to provide full adjustment for proper alignment of the stem. The stem bearing, in the stem guides, shall be brass or bronze brushed. The guides shall be anchored in an approved manner with not less than two bolts.

2.3.7 Asphalt and Sand

Asphalt and sand fill mixture shall be a relatively stiff mix of road asphalt and clean sand. The mixture shall be well tamped so as to have

full contact with the embedded frame, and so as to provide a firm fill in the recess.

2.3.8 Wall Bracket

All gatewell sluice gates shall have a top wall mounting bracket supplied by the sluice gate manufacturer. The bracket material shall be cast iron or fabricated steel of sufficient size and section thickness to support the weight of the gate when supported by the gate hoist above the bracket. In addition, stresses from operation in the closing mode with debris lodged under the gate shall be designed into the bracket. The sluice gate manufacturer shall provide anchor bolt recommendations to the Contractor for the size of the gate.

2.4 OPERATING HOISTS

2.4.1 Hoists

Each sluice gate shall be provided with a manual hoisting unit. Manual hoisting units shall be of the hand crank operated, enclosed, pedestal type, equipped with machine cut gears, having gear ratios recommended by the hoist manufacturer. The hoisting units shall be made of cast iron or cast steel. Exposed fastening of 1-1/2" diameter and less shall have American Standard hexagon-socket (Allen) type wrench heads. The hoist shall have a cast bronze lift nut, threaded to match and engage with the stem threads. The lift nut shall be provided with ball or roller bearings both above and below a flange on the lift nut, to accommodate the opening and closing thrusts. Each hoist shall be provided with an integral position indicator. A brass plate shall be attached to the lift housing to show counter reading with gate in fully closed position. Each hoist shall be designed to unseat the slide from its wedging device at the maximum head with a maximum force of 40 pounds at 15" radius. Means for lubrication of the hoist shall be provided. No more than 16 turns of the hand crank or handwheel shall be required to move the gate 1 inch. A removable, cast-iron crank with a rotating brass grip and a radius of 15" shall be provided. All hoists shall be capable of being driven by the same portable operator.

2.4.2 Position Indicators

Weathertight and dust-tight, stem-position indicators shall be provided for all gate stands. The indicators shall be of the dial- or counter-type, mounted in a cast housing on top of the lift, and with the face of the counter showing through a recessed window in the housing and easily read from the crank location.

2.4.3 Stem Covers

Weathertight and dust-tight stem covers shall be provided to enclose and protect the threaded portion of the gate stem. Slotted galvanized steel stem covers shall be provided. The top of the stem shall be visible through the slot throughout its distance of travel during opening and closing operations. The slot shall be covered with a vandal resistant clear plastic material as recommended by the stem manufacturer and as

approved. The above plastic material shall be installed as recommended by the stem manufacturer.

2.4.4 Bolts and Nuts

All anchor bolts for the rising stem type sluice gate frames and guides, stem guides, hoists and floor stands, and all bolts and studs used in the sluice gate leaves, frames and guides, and stem guides shall be stainless steel conforming to the requirements of ASTM A 276, Type 304.

2.5 PORTABLE OPERATOR

One portable hydraulic operating device shall be provided for opening and closing of all sluice gates in the project. The operator shall be portable, gasoline-engine powered, hydraulic-power unit mounted on a wheeled cart.

2.5.1 Hydraulic Motor Operator

The operator shall be portable and capable of opening and closing the gates at the speed and torque specified. The hydraulic motor shall be reversing-type. The dimensions of the coupling for connecting the motor to the gates shall be determined by the Contractor after gate selection. The hydraulic motor shall be designed for outdoor service and operate on power supplied by the hydraulic power unit. The hydraulic motor shall be capable of providing a minimum of 30 foot-pounds of torque for continuous duty while operating at a speed of not less than 140 RPM. The hydraulic motor shall develop a stall torque of 75 foot-pounds. Twenty feet of hydraulic reinforced hose suitable for pressures and flows shall be provided with the motor. An operating attachment shall be provided with the hydraulic motor. The attachment shall be designed to be received by an attachment plate on each gate hoist that aligns and secures the hydraulic motor to any operating hoist.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Installation Instructions

The setting, installation, assembly, lubrication, and testing of the gates and hoisting units shall be in accordance with the instructions of the gate manufacturer as approved by the Contracting Officer. These instructions shall be submitted for approval prior to any gate installation work. An erecting engineer shall inspect and determine the adherence to the above instructions for the setting of the gate thimble, rail assemblies, the stem guide anchor bolts, and the hoisting unit anchor bolts; the alignment and assembly of the stem to the sluice gate, stem guides, and hoisting unit; and observe the initial gate operations using the hoist. The Contractor shall make all arrangements for the presence of the erecting engineer for this inspection. The presence of the erecting engineer, however, will not relieve the Contractor of full responsibility.

3.1.2 Placement

Wall thimbles and anchor bolts shall be set in place prior to the placing of concrete. Each unit shall be accurately aligned and, if upon completion of the work there is any misalignment or other defective workmanship which is likely to impede the operation of the gate, the necessary corrections shall be made by the Contractor at no additional expense to the Government.

The bottom frame member of flush-bottom sluice gates shall be embedded in an asphalt mixture as shown.

3.1.3 Asphalt and Sand Mixture

Asphalt and sand fill mixture shall be a relatively stiff mix of road asphalt and clean sand. The asphalt material shall be Asphalt Cement (AC), Penetration Grade 120/150. The asphalt content shall not be less than 7% of the mix. The sand shall conform to the quality and gradation of fine aggregate for concrete as specified in ASTM C 33. The mixture shall be well tamped so as to have full contact with the embedded frame and to provide a firm fill in the recess.

3.1.4 Gate Vendor's Erecting Engineer

The erecting engineer shall be experienced in the specific installation of sluice gates as a complete system. Installation experience shall include as a minimum three successful installations of which at least one must have been in the last two years and at least one must have been a gate of the larger size furnished with this project. The Gate Vendor shall coordinate with the Contractor on the most advantageous times and durations necessary for his erecting engineer to be at construction site and be confident of the proper installation and operational function of their product. The Vendor's erecting engineer shall initiate instructions for all actions necessary for the proper receipt, inspections, handling, assembly, installation, operation, and testing of this sluice gate system furnished by his company under this contract. Discrepancies shall be reported to the Contracting Officer. The Vendor's erecting engineer shall also keep records of measurements and actions taken during his visits and shall furnish a copy to the Contracting Officer on request or at the completion of each visit. Multiple visits may be required depending on installation sequencing. One of the visits shall be during final preparation and performance of the installed acceptance test. The erecting engineer shall instruct the Contractor in the operation and maintenance features of his company's installed sluice gate product. The following information will be submitted with the submittal package to verify the qualifications of the engineer:

- a. Experience, years of service, etc., as an erecting engineer.
- b. List of successful gate installations with owner's address and phone number.
- c. Size and type control of the installed gates.

3.1.5 Assembly

Prior to assembly, the gate stems shall be thoroughly cleaned, for

inspection by the Contracting Officer or his representative. All parts of the gates and operating mechanisms shall be installed and fitted together so that after final assembly there will be no interference through bad alignment, or any warping or twisting of the members that would in any way interfere with operation. All finished contact or bearing surfaces shall be true and exact to insure full and complete contact. All bolts for attaching the gate frames, stem guides, and operating hoists shall be accurately embedded at the time of placing concrete. Provisions for lubrication of the operating mechanisms shall be made and the lubrication systems shall be properly filled with suitable lubricant as recommended by the manufacturer of the hoists. When the sluice gate slide is in the fully closed position and wedged in position against the frame, maximum clearance between mating faces shall not exceed 0.004 inch.

3.2 TESTS

After final assembly, each gate shall be tested in the presence of the gate vendor's erecting engineer and the Contracting Officer or his representative by raising and lowering it throughout its complete travel by means of its operating mechanism and to demonstrate that it complies with the specifications. Any defective part or error in the construction or alignment of the complete gate discovered during the tests and trials shall be immediately corrected by the Contractor without cost to the Government.

3.2.1 Demonstration of Proper Functioning

Upon completion of the installation, each gate shall be lubricated and operated through as many cycles of opening and closing as may be necessary to demonstrate proper functioning of the gates and that the units are free from binding or other defects.

3.2.2 Testing

The portable operator shall be tested in the presence of the Contracting Officer in raising and lowering the gates.

3.3 PAINTING

The gate manufacturer shall be responsible for shop prime and finish painting of all sluice gates and appurtenances supplied under this contract. All coatings shall conform with VOC Emission Regulations in effect at the manufacturing location and at project site to allow touch-up or recoating to be performed with the same products. The type of paint shall be as specified in the following schedule. Where required by application the coating shall be approved for contact with drinking water by the NSF, EPA, or other appropriate governing agencies. Number of coats, mil thickness and surface preparation shall be in accordance with the paint manufacturer's recommendations for that application, but in no case shall be less than the requirements in the following schedule. All coatings shall be free of carcinogens as listed on the IARC monographs. Colors are to be manufacturer's standards, provided they are selected for ease of manufacturer's standards, provided they are selected for ease of field

touch-up and color match and are fade resistant. Colors shall be selected to provide contrast between the product and the prime coat, and between the prime coat and the finish coat, to insure uniform covering and coating thickness. All coatings shall be applied in accordance with the paint manufacturer's recommendations for thinning, technique and safety precautions.

3.3.1 Painting Schedule

| Application | Materials | Preparation | 1st Coat | 2nd Coat | 3rd Coat |
|-------------------------|-----------|-------------|---|---|----------|
| Gates, Wall Thimbles | Cast Iron | SP 6 | Amine Mod. Pol. Epoxy Amerlock 400 or Equal, 5 mils, min. | Amine Mod. Pol. Epoxy Amerlock 400 or Equal, 5 mils, min. | None |

3.4 TOOLS

One set of wrenches and special tools required for the operation and maintenance of the sluice gates installed under this contract shall be furnished at the time of the trial operation.

3.5 QUALITY CONTROL

The Contractor shall establish and maintain quality control for work under this section to assure compliance with contract requirements and maintain records of his quality control for all construction operations including, but not limited to, the following:

- a. Materials and workmanship.
- b. Installation.
- c. Trial operations of each gate.
- d. Adjustment.

A copy of the records of inspections and tests, as well as the records of corrective action taken, shall be furnished to the Government as directed by the Contracting Officer.

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SECTION 15055

ELECTRIC SLUICE GATE ACTUATORS

04/01

PART 1 GENERAL

1.1 SCOPE

The work covered by this section consists of the shop fabrication, assembly, and protective coating; delivery to the construction site; installation; and field testing of rising-stem-type electric sluice gate actuators from a standard product line. A firm regularly engaged in the valve actuation industry for not less than the past 5 calendar years shall furnish the specified actuators. The equipment shall operate in ambient air temperatures between 0 degrees F and +100 degrees F.

1.2 RELATED WORK OF OTHER SECTIONS

The following items of related work are covered under other sections:

1.2.1 Fabrication

SECTION 05500: MISCELLANEOUS METALS

1.2.2 Painting

SECTION 09900: PAINTING, GENERAL.

1.2.3 Sluice Gates, portable actuators

SECTION 15050: SLUICE GATES.

1.3 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 Gear Manufacturers Association (AGMA))

AGMA 374.04 (1973) Design for Fine-Pitch Wormgearing

AGMA 6034B (1986) Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors

American Institute of Steel Construction (AISC)

AISC S329 (1985) Allowable Stress Design
Specifications for Structural Joints Using
ASTM A325 or A490 Bolts

AISC S335 (1989) Structural Steel Buildings
Allowable Stress Design and Plastic Design
with Commentary

American National Standards Institute (ANSI)

ANSI B1.5 (1988) Acme Screw Threads

ANSI B4.1 (1967) Preferred Limits and Fits for
Cylindrical Parts

ANSI B4.2 (1978) Preferred Metric Limits and Fits

ANSI B17.1 (1967) Keys and Keysets

ANSI B46.1 (1985) Surface Texture (Surface Roughness,
Waviness, and Lay)

ANSI Y14.1 (1980) Drawing Sheet Size and Format

American Society for Testing and Materials (ASTM)

ASTM A 325 (1992) Structural Bolts, Steel, Heat
Treated, 120/105 ksi Minimum Tensile
Strength

ASTM B 21 (1983) Naval Brass Rod, Bar and Shapes

ASTM B 209 (1992) Standard Specification for Aluminum
and Aluminum-Alloy Sheet and Plate

American Welding Society (AWS)

AWS A2.4 (1993) Standard Symbols for Welding,
Brazing and Nondestructive Examination

AWS D1.1 (1990) Structural Code Steel

American Water Works Association (AWWA)

AWWA C540 (1987) Power-Actuating Divices for Valves
and Sluice Gates

National Fire Protection Association (NFPA))

NFPA No. 70 (1993) National Electric Code

U.S.ARMY CORPS OF ENGINEERS, ENGINEERING MANUALS (EM)

EM 385-1-1

(1992) Safety and Health Requirements
Manual

1.4 SUBMITTALS

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

SD-01 Data

Purchased Component Data; GA

Shop drawings for components that are ordinarily commercially available, such as manufacturer's catalog items, shall be submitted along with their associate fabrication drawings to the Contracting Officer for review and approved prior to issuance of respective purchase orders. The shop drawings shall be sufficiently detailed to show: design configuration and assembly; principal dimensions, assembly weight, load capacities, and ratings; applicable standards, grades and classifications of the materials used in manufacture; coating (painting) and other types of material protection; and lubrication requirements. Each drawing shall also indicate all dimensions, fits, and surface finishes affecting mating parts.

SD-04 Drawings

Fabricated Components; GA.

Shop drawings that cover components that are or will be designed specifically for the contract work and which are not ordinarily commercially available, shall be submitted in full detail to the Contracting Officer for review and approval. The shop drawings shall be organized in a logical progression from main assembly drawings to details and shall be neat and legible and follow standard drafting practices as approved. Shop drawings shall include all required information including: materials, treatments, dimensions, weights, tolerances, weld symbols, finishes, cross-references to additional drawings, and other pertinent information. Each shop drawing shall be identified with a title block containing the following: the name of the Contractor, contract number, name and location of the project work, the name(s) of the manufacturer(s)/fabricator(s), the name(s) of the contract work item to which the shop drawing applies, and an individual shop drawing sheet number. Shop drawings shall be submitted and approved prior to ordering any materials or commencing fabrication associated therewith. Welds, heat treat and non-destructive testing shall be indicated by standard symbols in accordance with AWS A4.2. Surface finishes shall be in accordance with ASTM B 46.1.

SD-01 Data

Protective Coatings Procedures; GA

After approval of the shop drawings, but not later than commencement of fabrication work, the Contractor shall submit catalog information, samples, and procedures for the preparation and coating of items in accordance with PARAGRAPH: EXECUTION OF WORK. The procedures shall include full details of the surface preparation methods and coating systems to be applied, colors, number of coats and dry thicknesses, inspection, and testing and acceptance criteria. Procedures shall identify the sources for coating of purchased components. Procedures shall address requirements for touch-up protective coating after assembly and/or delivery.

SD-04 Drawings

Delivery Drawings; FIO

Shall provide descriptions of methods of delivering components to the site including details for supporting fabricated components during shipping to prevent distortion or other damage. Shall also include a components storage plan.

SD-04 Drawings

Erection Drawings; GA

Shall provide detailed descriptions of the steps necessary for field installation. The descriptions shall include the locations and methods of support for installation and handling; additional means necessary to provide stability and prevent warping, distortion and other damage of critical areas and components; methods necessary to assure proper alignment; and details for connecting the adjoining fabrications and components as shipped to the site.

SD-04 Drawings

Final Revised Shop Drawings; GA

The Contractor shall make corrections to all shop drawings submit: five bound copies on 11 inch by 17 inch size paper and one copy of the computerized views on disk(s). The Contracting Officer will return one copy of this submittal, within 45 calendar days of receipt by the Contracting Officer, with review comments to be responded to and/or incorporated into the final revised version of the shop drawings. Upon approval and in accordance with PARAGRAPH: POST EXECUTION OF WORK, the Contractor shall incorporate comments and/or responses and submit the final revised shop drawings as follows: 10 bound copy sets of on 11 inch by 17 inch size paper; 2 reproducible sets on 22 inch by 34 inch size mylar; and 2 copies of the computerized views on disk(s).

SD-06 Instructions

Spare Parts List; FIO

After approval of shop drawings, but not later than 30 calendar days prior

to the first article testing, the Contractor shall submit a list of proposed recommended spare parts. The list shall include at a minimum a complete listing with catalog and parts numbers required spare parts in accordance with PARAGRAPH: EXECUTION OF WORK.

SD-08 Statements

Shipment and Storage Procedures; GA

Protective Packaging For Shipment And Storage Procedures: After approval of shop drawings, but not later than 60 calendar days prior to the completion of fabrication work, the Contractor shall submit the proposed procedures for protective packaging and storage of the equipment for shipment to each point of delivery in accordance with PARAGRAPH: POST EXECUTION OF WORK.

SD-08 Statements

Installation and Start-Up Procedures; GA

Installation And Start-up Procedures: After approval of protective packaging for shipment and storage procedures, but not later than 60 calendar days prior to the first article testing, the Contractor shall submit to the Contracting Officer for review and approval proposed procedures detailing necessary installation and start-up from storage procedures in accordance with PARAGRAPH: POST EXECUTION OF WORK. Final approval will be contingent upon the following: the Contractor's acceptable responses to the Contracting Officer's review comments; related incorporation of acceptable responses in the revised procedures; and submittal of 5 revised sets of procedures, including receipt of such by the Contracting Officer prior to the first article testing.

SD-08 Statements

Warranties; FIO

One copy of each warranty shall be submitted for approval not later than 60 calendar days after completion of the first article testing.

SD-09 Reports

Design Computations; GA

The Contractor shall include an enumeration of the various design factors and assumptions, including actual computations, to the extent necessary for the Contracting Officer to verify that each submitted shop drawing meets the requirements of PARAGRAPH: DESIGN.

SD-09 Reports

Variance Requests; GA

The Contractor shall submit variance requests for all deviations from the contract requirements. The consequences of introducing substitute materials, fabricated components, purchased components, etc., that are

different dimensionally or otherwise from the contract requirements shall be properly noted by the Contractor on each appropriate shop drawing prior to submitting. Additionally, substitute designs shall include descriptive material and preliminary design data in sufficient detail to show the proposed item(s) will meet or exceed the original contract requirements. Unless required otherwise, time needed for preparing, submitting, and reviewing variance requests will not be grounds for changing the contract schedule and/or period. The Contractor shall not vary from the contract requirements until it has received written approval to do so from the Contracting Officer.

SD-13 Certificates

Purchased Component Certification; FIO

Manufacturer's certification of compliance: As required, the Contractor shall obtain written certification from each manufacturer that the manufacturer's products furnished under this contract comply with the contract requirements and submit each such certification to the Contracting Officer.

SD-14 Samples

Product Samples; GA

Representative product samples shall be submitted with the catalog information submittals as required or as requested and returned to the Contractor if over a value of \$ 10.00 U.S. dollars.

SD-19 Operation and Maintenance Manuals

Operation and Maintenance Manuals; GA

Not later than 60 calendar days prior to field testing, the Contractor shall submit to the Contracting Officer for review 5 sets of Electric Sluice Gate Actuator operation and maintenance subsections to be later inserted to those sections of the pump station Operation and Maintenance manuals assembled by others. The Contracting Officer shall return one copy of this submittal with any review comments to be responded to and/or incorporated into a second submittal handed out during the field tests. These operation and maintenance instructions shall be reviewed as part of the field tests procedures. Within 15 calendar days following the approval of the completed field tests the Contracting Officer shall return one copy of this second submittal with any additional review comments to be responded to and/or incorporated into the subsection. Upon approval, the Contractor shall incorporate comments and include these subsections as part of the 10 complete copies of the final revised pump station Operation and Maintenance manuals.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

2.1.1 General

The design selection of products proposed for purchasing (electric actuators); their accuracy of integration; and the adequacy of the fabricated parts shown shall be the responsibility of the Contractor and design information of such shall be submitted for approval. The Contractor shall be responsible for determining all interfaces (keys, keyways, cylindrical fits, surface finishes, mating tolerances, bolted connections, continuous full penetration weldments, etc.) between purchased products and fabricated parts in order to meet the design, maintenance, and operational contract requirements.

2.1.2 Design

Unless required otherwise, individual products shall provide an endurance rating equal to or greater than stresses induced through 125 percent of the full operating loads for a design life of not less than 30,000 hours, and stresses induced from the maximum motor stall loads shall not exceed 75 percent of the material yield strength of any of the products. The design of steel fabrications shall meet as a minimum the requirements specified for the combined stresses and deflections induced statically and dynamically from the maximum output torque of the electric actuator during motor stall while taking into consideration stress concentration factors for holes, notches, and fatigue. Unless required otherwise, where conflicts between contract requirements and industrial standards occur, the more conservative criteria shall govern.

2.1.2.1 Gate Load

The sluice gate design load shall be determined from the following equation:

$$F = (62.4 \text{ lbs/ft}^3) \times f \times A \times H \times T \times P1 \times P2$$

where:

- F = gate load in pounds
- f = 0.6 friction factor of slide against seat
- A = area of gate opening in feet²
- H = head of water at gate center in feet from TABLE I
- T = 1.0 for seating or 1.5 for unseating type water head
- P1 = weight of slide in pounds (lbs)
- P2 = weight of stem in pounds (lbs)

2.1.2.2 Actuator Torque

The Contractor shall select the rising stem, electric sluice gate actuators for the gates specified in SECTION 15050: SLUICE GATES from a standard product line of same manufacturer as proposed for the sluice gate hoists in accordance with AWWA C540. Each electric actuator unit shall contain sufficient speed reduction so that when in conjunction with the thread pitch of the proposed rising stems of the sluice gates shall provide a travel rate between 0.9 to 1.1 feet per minute; and a minimum output stem torque as determined to lift the gate design load with a minimum of 15 minutes continuous duty cycle including a minimum of 15 starts per hour.

$$T = 0.5(F \times pd) \times ((ld + \phi \times f \times pd)/(\phi \times pd - f \times ld))$$

where:

T = actuator torque in inch pounds
F = gate load in pounds
pd = pitch diameter of stem in inches
ld = lead in inches that the stem moves in one revolution
phi = 3.142
f = 0.3 friction factor of stem against nut

2.1.3 Lifting Lugs

The Contractor shall incorporate lifting lugs into the design so as not to hinder operation for all products, components, and assemblies exceeding 200 pounds gross weight so that slings for handling by a crane may be readily attached and the lugs may remain following installation.

2.1.4 Permanent Markings

The Contractor shall mark in a permanent manner, as not to be hidden following application of protective coatings, all matched products, fabricated parts, modular subassemblies, installation alignment lines and as otherwise specified herein.

2.1.5 Standard Measurement Units

All design computations and fabricated frames, including fasteners, shall be manufactured and built in accordance with conventional English units (inch, pound, second, etc.).

2.1.6 Special Tools

One set of wrenches and special tools required for the operation and maintenance of the sluice gates installed under this contract shall be furnished at the time of the field testing specified in PARAGRAPH: POST EXECUTION OF WORK.

2.1.7 Nameplates

Each nameplate shall be made of corrosion resistant metal with raised or depressed lettering on a contrasting colored background. All items shall have standard nameplates as provided by the respective manufacturer.

2.1.8 Safety Devices

Exposed moving parts, high temperature parts, parts which may be electrically energized, and parts that are of such nature or are so located as to be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or otherwise fitted with approved safety devices. Each safety device shall be installed in such a manner that proper operation of the equipment is not impaired. Unless otherwise approved by the Contracting Officer in writing, all contract work items shall be in accordance with EM 385-1-1.

2.1.9 Workmanship

Workmanship shall be of the highest quality and in accordance with the best modern manufacturing and fabricating procedures in order to conform with the contract requirements.

2.1.10 Parts and Service Resources

The manufacturers of all equipment that shall be furnished under this contract shall have resources located such that each request for parts and/or service can be made available at the pump station within 24 hours after receipt of such request. Each resource shall be capable of supplying spare replacement parts and providing field/shop repair service for equipment and items that are covered under this contract.

2.2 FABRICATIONS

2.2.1 General

In general all fabrications shall be in accordance with SECTIONS: METALWORK FABRICATION, MACHINE WORK AND MISCELLANEOUS PROVISIONS , and as specified herein. Dimensional tolerances and allowable stresses shall not exceed those specified in AISC S335. Combined bi-axial stresses shall be in accordance with the Von Mises-Hencky criteria. In addition to strength, the floor stands shall be designed for rigidity and have an inertia area sufficient to limit deflection not to exceed 0.001 inch deflection per unit length with 0.20 percent of the maximum actuator load applied horizontally at the top of the base. All bolted connections shall be in accordance with AISC S329. Steel shall be of equal mechanical strength as that of ASTM A36 unless otherwise specified herein. All welds shall be continuous, full penetration groove, of size and type determined by the Contractor and shown on the shop drawings in accordance with AWS A2.4 with heat treat and non-destructive testing requirements for approval. Surface finishes shall be in accordance with ANSI B46.1.

2.2.2 Floor Stands

The floor stands shall totally be enclosed primarily consisting of the pedestal base and actuator adapter plate equipped with all necessary fasteners. The Contractor shall determine the height of the floor stand necessary to elevate the handwheel of the approved actuator 42 inches above the gatewell grating. The pedestal base shall be fabricated of, 6 inch square, structural steel tubing having a minimum wall thickness of 3/8 inch equipped with top and bottom flanges as shown. The bottom flange shall be a minimum of 1-1/2 inch in thickness template drilled for 15/16 inch diameter holes for 7/8 inch attachment bolts. The top flange and actuator adapter plate shall be a minimum of 3/4 inch in thickness, matched, and template drilled for 13/16 inch diameter holes for 3/4 inch diameter mounting bolts of length as determined by the Contractor. All mating surfaces of the top flange and adapter plate shall be machined to a surface finish of 125 micro-inches. The adapter plate shall be template drilled to match the mounting screw pattern and pilot hole of the approved actuator. Each floor stand shall be shop coated in accordance with PARAGRAPH: PAINTING.

2.2.3 Stem Covers

The weathertight and dust-tight stem covers shall be provided to enclose and protect the threaded portion of the rising stem which projects above the gate actuator. Stem covers shall primarily consist of standard galvanized pipe fittings, clear butyrate plastic pipe and end cap. As a minimum for each stem cover, the pipe fittings shall consist of threaded pipe support flange, full threaded nipple with two outside hex head bushings to serve as lock nuts, and reducer fitting. The nipple shall be of length as determined by the Contractor and approved by the Contracting Officer to provide sufficient vertical adjustment of the gate height indicator. The butyrate pipe shall be of sufficient diameter to mount the gauge of the gate height indicator inside and along side the rising stem at a clearance distance of not less than 1 inch. The clear butyrate plastic pipe shall be of material resistant deterioration from temperature changes from 0 to 10 degrees F and ultra violet light to prevent discoloring and cranking as submitted to the Contracting Officer for approval.

2.2.4 Gate Height Indicators

The gate height indicator shall primarily consist of a graduated steel rule type gauge mounted along side the rising stem and located inside the butyrate stem cover with a pointer mounted to the top of the rising stem. The gauge shall be of heavy spring steel 1/10 inch thick with a satin chrome finish machine divided to precision increments. The gauge shall be mounted perpendicular against the inside wall of the butyrate stem cover with a continuous 1/8 inch thick angle of ASTM B 209, tempered alloy 6061-T6, aluminum. The gauge shall be aluminum pop-riveted to one leg of the angle with the other leg equipped with threaded mounting nuts evenly spaced approximately every 12 inches and permanently fastened by a spot welding process or as determined by the Contractor and approved by the Contracting Officer. The mounting holes in the butyrate stem cover shall be slotted for a minimum of 1 inch vertical movement. The pointer shall be mounted to the stop collar of the rising stem in such a manner as approved by the Contracting Officer that the tip is no more than 1/16 inch from the edge of the gauge and painted red in color with an oil base enamel.

2.3 PRODUCTS

The Contractor shall submit descriptive catalog information for approval for each product (component) along with the manufacturer's certificate of compliance that certifies the product furnished under this contract meets or exceeds the required conditions, ratings, and maximum transmitted forces. Each product shall be from a standard product line of manufacturer regularly engaged in the commercial production of the type and quality of component referred for a minimum of the last five years and having a minimum of a 95 percent reliable field operation record. The Contractor shall be responsible for all deviations in mating dimensions of the approved products with the fabricated materials.

2.3.1 Multi-Turn Electric Actuator

The Contractor shall select the multi-turn electric actuators in accordance

with AWWA C540 from the standard lots of in stock ratios from a standard product line of the same manufacturer regularly engaged in the valve actuation industry. The electric actuator shall be of modular design primarily consisting of an electric motor, brake (optional); and enclosed controls, gear reducer, gate and position indicator; equipped with a manual handwheel.

2.3.1.1 Motor

The motor shall be an independent part of the actuator directly flanged mounted to the actuator enclosure to allow replacement. The motor design shall be reversible, three phase, 60 Hz, 480 volt-AC , totally enclosed, non-ventilated, construction. The motor insulation shall be resin type of a minimum NEMA class F, with a maximum continuous temperature rating of 155 degrees C (rise plus ambient) for one complete fully open to fully closed duty cycle of not less than 15 minutes under the determined design torque from PARAGRAPH: DESIGN. The insulated windings shall be completely assembled in the motor core before vacuum impregnation. The windings shall be securely held in the core slots by wedges of high strength non-hygroscopic material suitable for the temperature rise of the insulation class. The curing process shall consist of not less than two vacuum dips, including draining and baking for each dip of the resin type insulation in order to fill in and seal over all intricacies of the windings. The motor shall be equipped with internal thermal contacts factory wired into the control circuit to protect against damage due to excessively high temperatures. The magnet wire shall be in accordance with NEMA MW 1000 for double covered insulation rated for the hot-spot temperature of the motor. The motor shall also be equipped with 120 volt-AC heaters wired along with the control enclosure heater in a separate circuit such that when power is cut to the controls the heaters will continue to operate. Heaters shall be installed in the motor frame. Heaters shall be of such rating that when energized the temperature of the motor windings will be held approximately 10 Centigrade degrees above ambient air temperature. Heaters shall withstand at least 10 percent continuous over-voltage. The rate of heat dissipation shall be uniform throughout the heater effective length. The motors shall be provided with sealed anti-friction bearings. The motor housing shall be designed to allow removal of the end brackets, and prevent escape of lubricants or entrance of foreign materials.

2.3.1.2 Brake

The motor shall be equipped with a brake unless computations are submitted that show the total speed reduction is self-locking up to two times the actuator design torque. The brakes shall be disc or conical type, spring set, electrically released, self adjusting type, completely enclosed for water/dust tight direct NEMA face motor mounting. The discs shall have splined hub with woven non-asbestos linings. Means shall be provided to field adjust the holding torque. The braking capacity shall be a minimum of 150% of the maximum output torque of the motor. The solenoids shall operate in a minimum ambient temperature range from -30 oF to +120 oF and have a minimum of Class F insulation rated for the brake requirements. A manual release knob shall be provided through the brake housing which automatically resets upon restart. Brakes shall be equipped with an

internal heater and automatic drain-breather valve for low temperature and high humidity operation.

2.3.1.3 Controls

As a minimum, motor, travel and torque limiting controls shall be of modular designs provided as an integral part of each actuator, mounted inside the NEMA 4 rated, accurately machined, template drilled, gasketed, cast metal enclosure along with the 120 volt-AC control transformer, space heater, and mechanical reversing contractor type motor starter. The 120 volt-AC electric space heater shall be thermostatically controlled and wired along with the motor heater in a separate circuit to be connected to a separate power supply such that when the power is shut off to the pushbutton station, by the ON/OFF keyed switch, the all heaters will continue to operate. A caution warning note shall be displayed that indicates motor heaters are powered even 480 volt is disconnected. All control wiring shall be factory wired in accordance with NFPA 70 to either a terminal strip or plug/socket type connector equipped with a minimum of two threaded conduit entrances to facilitate a minimum of field wiring. All contactors shall be silver plated and rated for 600 volts. Provisions shall also be included to electrically connect each actuator for remote motor control and position transmittance (4 to 20 mA signal) at a later date by others.

(1) Motor Control

. The motor, as a minimum shall be controlled from a (ON/OFF) key activated three pushbutton station. The pushbuttons shall be permanently stamped or raised labeled "OPEN", "STOP" and "CLOSE" located underneath a movable padlockable metal cover, or equal as submitted to the Contracting Officer for approval to deter vandalism. The key operated (ON/OFF) selector switch shall not be labeled and shall use matched keys between gate electric actuators, with the key removable only in the OFF position to provide a secondary security measure to restrict operation of the push buttons.

(2) Travel Limit Switches

Travel limit switches shall be directly geared to the drive mechanism, totally enclosed, and in step at all times whether the unit is operated electrically or manually. The drive mechanism shall be made of corrosion resistant metal material, supported in bushings and permanently lubricated in the factory. The switches shall be of the adjustable type, field set, to trip and automatically shut off the motor at the fully open and fully closed gate positions. The motor shall then only be allowed to be energized in the opposite direction of the travel limit shut off. The limit switches shall not be subject to breakage or slippage due to over-travel. Limit switch contacts shall be heavy duty, silver plated with wiping action. Contacts shall be convertible from N/O to N/C or reverse. The switch design shall permit visual verification of switch position without disassembly. The drive mechanism and setting instructions shall be detailed and included in the manufacturer's O & M manuals for future travel limit switch adjustments.

(3) Torque Limit Switches

Each actuator shall include a set of adjustable torque or thrust-limiting switches capable of cutting off the power to the motor when the gate encounters an obstruction in either direction of travel. The torque limit switches shall be of the axially displaced worm pinion against disk spring packs principle. The Contractor shall submit to the Contracting Officer the manufacturer's output torque curves associated with each available disk spring pack for the proposed actuator and indicate the recommended spring pack for approval. Following approval of the spring pack the Contractor shall submit actual manufacturer certified test results to the Contracting Officer, cross referenced to the serial number of each actuator, showing a plotted output torque curve in foot-pounds verses the dial setting as shown in the actuators themselves. The torque switches shall be factory set by the manufacturer for the approved setting. The drive mechanism, certified torque curves, and setting instructions shall be detailed and included in the manufacturer's O & M manuals for future torque limit switch adjustments.

2.3.1.4 Gear Reducer

The enclosed gear reducer shall meet AGMA 6034 and as specified for the enclosed speed reducers below. Gearing shall be designed and manufactured in accordance with AGMA 374.04. The worm pinion shall be single piece construction of hardened alloy steel and supported at each end by anti-friction bearings. The gear shall be of nickel or manganese bronze, keyed to a hollow output shaft and supported at each end by anti-friction bearings. The hollow output shaft shall be factory line bored as approved by the Contracting Officer with a clearance fit in accordance with ANSI B4.1 or B4.2 and keyed per ANSI B17.1 to the bronze stem nut having a brinell hardness a minimum of 100 BHN less than that of the stem. The internal threads of the stem nut shall match the ACME size and type of the stem selected in SECTION: 15050 SLUICE GATES in accordance with ANSI B1.5 for a minimum of class 2G fit.

2.3.1.5 Gate Position Indicator

Each actuator shall be equipped with a direct, gear driven, mechanical dial type position indicator. The dial face shall be graduated in equal marks each to represent approximately 6 inches of gate travel from fully closed to fully open. The indicator shall not be calibrated for the final output speed but the speed of the gate. The gear ratio of the position indicator shall take into account the pitch of the rising stem. All gearing shall be made of corrosion resistant metal material supported in bushings and permanently lubricated in the factory.

2.3.1.6 Handwheel

Each actuator shall be equipped with a metal handwheel for manual operation. Handwheels shall include a crank handle equipped with a smooth brass grip rotating freely. The handwheel shall be connected so that operation of the motor will not cause the handwheel to rotate and the operation of the handwheel shall not cause the motor rotor to rotate. Should the power return to the motor while the handwheel is in use, the design of the unit shall prevent the power from being transmitted to the

handwheel. The handwheel shall require an effort of no more than 40 pounds on the rim to achieve the specified design output torque. An arrow and words "OPEN" or "CLOSE" shall be permanently stamped or raised labeled on the enclosure to indicate direction of resultant gate movement. Change from motor operation to handwheel operation shall be accomplished by a positive padlockable declutch lever which mechanically disengages the motor and related gearing. Friction type declutch mechanism will not be acceptable.

2.3.1.7 Lubrication

The enclosure shall include lubrication provisions to all working parts including the gate stem. All gearing and bearings shall be lubricated in accordance with the manufacturer's recommended practices to permit non-winter operation in a minimum ambient temperature range from 0 oF to +100 oF.

2.3.1.8 Testing

All electric actuators shall be tested and certified by the manufacturer prior to shipping them to the Contractor; the Contractor shall submit a copy of each such test result and certification.

PART 3 EXECUTION

3.1 PROTECTIVE COATINGS

All exposed parts shall be shop coated except for machined surfaces and other specified areas. Floor stands shall be surface prepared in accordance with ferrous metals as specified in SECTION: 09900PAINTING, GENERAL then galvanized as specified in SECTION: 05500 MISCELLANEOUS METALS. The remainder of the surfaces shall be shop coated in accordance with system PS-13.01, as specified in SECTION: 09900PAINTING, GENERAL. Prior to applying the specified coating, all previously painted surfaces shall be thoroughly cleaned of all grease, or other foreign material using solvent, mechanical cleaning methods. Entire surface area sanded rough with all cracks, blisters or other deteriorations feathered smooth. Machined and threaded surfaces shall receive a protective coating as specified in SECTION: 05500 MISCELLANEOUS METALS. Painting in accordance with manufacturer's standard practice and recommendation, as submitted and approved by the Contracting Officer, may be substituted if equal or better than that specified.

3.2 MODULAR SUBASSEMBLIES

Following the application of protective coatings, the Contractor shall completely shop reassemble to the most practical extent possible all products and fabricated components of each modular subassembly. All mating flanges between equipment shall receive a thin film of anaerobic type gasket sealant similar to Gasket Eliminator 518, and all threads of fasteners shall receive a thin film of medium strength Threadlocker 242 which remains removable with only handtools similar to as manufactured by Loctite Corporation, Newington, Connecticut. Each complete modular subassembly shall then be inspected to determine the correctness of

fabrication, aligned to assure that binding of moving parts shall not occur, and tested and certified for operational compliance prior to shipment. Small miscellaneous products may be crated separate. In order to assure proper protection during shipment, other products may be crated separately following the approval of the Contacting Officer; but their installation must then be addressed in the installation procedures.

3.3 SPARE PARTS

Except for the touch-up paint, all spare parts associated with the pump station shall be furnished inside a protective crate with a hinged top. The following lists the minimum type and quantity of required spare parts that the Contractor shall supply for each of the required gate actuators.

3.3.1 Electrical

- (1) One complete motor starter module for a electric gate actuator.
- (2) One complete travel limit switch module for a electric gate actuator.
- (3) One complete torque limit switch module for a electric gate actuator.
- (4) Three fuses for each fuse size and type.

3.3.2 Mechanical

- (1) Complete set of speed reducer shaft seals for each seal and reducer type.
- (2) One clear butyrate plastic stem cover pipe and end cap for each rising stem actuator.
- (3) Individually packaged touch-up coating for each required coating type and color.
- (4) 4 Individually packaged anaerobic type gasket sealant and threadlocker, for each type, in quantities necessary to complete installation.
- (5) Individually packaged lubricants, for each type, in quantities necessary to complete installation and start-up.
- (6) Special tools as required by PARAGRAPH: GENERAL.

3.4 PROTECTIVE PACKAGING AND STORAGE

The Contractor shall prepare for the pump station the modular assemblies and their separately packaged products as described in PARAGRAPH: EXECUTION OF WORK, along with the spare parts listed above, for shipment and outdoor storage at the construction site. The packaging shall protect them from damage, outdoor exposure, deterioration by corrosion, high humidity, and

animal habitation. Each package shall be plainly marked to identify the contents and total gross weight. Larger self-contained fabrications of the modular assemblies shall be palletized a minimum of 4 inches off the ground and tagged to identify their total gross weight. Details such as crating material, linings, and dimensional sketches of these packages shall be submitted to the Contracting Officer for approval. Prior to the release of equipment for shipment, the Contractor shall submit to the Contracting Officer an itemized list of specific packages, their contents, gross weights, and anticipated delivery dates. The Contractor shall furnish all special handling devices determined necessary, but need only to be shipped with the first required delivery if of a re-usable nature. The Contractor shall make good all damage caused by improper preparation, storage, or loading for shipment.

3.5 INSTALLATION AND START-UP

3.5.1 Procedures

In accordance with PARAGRAPH: SUBMITTALS, the Contractor shall submit, as prepared by the hoist fabricator, detailed procedure based on a proper sequence of installation. The procedures shall include descriptions for unloading, unpacking, installation, assembly, lubrication, all field connections of the power and control wiring, and alignments from the packages, as shipped, to complete operational sluice gate and sluice gate hoist assemblies. The procedures shall identify the proposed visits by the Contractor's erection engineering staff. These procedures, as approved, will be utilized by those responsible for the assembly and field testing of the sluice gate and sluice gate hoist assemblies as a completed at the pump station.

3.5.2 Installation

The Contractor shall install all modular subassemblies of the electric sluice gate actuators under the supervision of an erection engineer. The erection engineer shall be provided by the Contractor and shall be familiar with the hoist being installed, preferably, the erection engineer will be from the sluice gate and electric actuator manufacturers. The following workmanship practices are not comprehensive but indicate the expected workmanship to be followed.

3.5.2.1 Alterations

The Contractor shall not make alterations to machinery or equipment to ease installation without the approval of the Contracting Officer.

3.5.2.2 Dimensions, Clearances, and Tolerances

Strict adherence to handling methods, alignment dimensions, clearances, and tolerances will be a requirement for approval of the installation unless altered in writing from the Contracting Officer.

3.5.2.3 Cleanliness

Protect to maintain cleanliness of the external and internal parts of the

machinery. Protect bearings of all types at all times against the possible entrance of foreign matter. Thoroughly clean each bearing into which foreign matter has penetrated with an approved solvent of the bearing manufacturer, and re-lubricate.

3.5.2.4 Cleaning

Clean all machined mating surfaces of paint and all foreign matter before assembly of equipment. Remove corrosion and rust with a high-grade rust remover applied with lint-free cloths. Materials used for the removal of protective coatings shall be clean and free of grit or dirt to avoid damage to surfaces. Damage caused by misapplication of solvents or use of unsuitable cleaning materials shall be the responsibility of the Contractor.

3.5.2.5 Gasket Sealant

Add a thin film of anaerobic type gasket sealant similar to Gasket Eliminator 518 to all mating flanges between equipment and a thin film of medium strength Threadlocker 242 to all threads of fasteners, similar to as manufactured by Loctite Corporation, Newington, Connecticut.

3.5.2.6 Field Welding

Field welding shall clamp the current conductor as near as possible to the work area in which the weld is to be made. The current conductor shall never be clamped in such a location that bearings and/or electrical controls occur between the clamp and the weld area.

3.5.2.7 Damaged Coatings

Deteriorated and damaged areas of the shop applied coatings shall be repaired. Edges of chipped paint shall be feathered edged and sanded smooth. Rusty metal surfaces shall be cleaned as per SSPC requirements. Mechanical and solvent cleaning methods shall be used to provide surface suitable for painting. Touch-up coatings shall be compatible with the existing coatings.

3.5.3 Erection Engineering Services

The Contractor shall furnish the services of an erection engineering staff having experience in the specific installation of sluice gates, and electric actuators similar in size and capacity to those specified to complete operational systems. In accordance with PARAGRAPH: SUBMITTALS, the Contractor shall submit for approval the name of each individual the Contractor proposes including a short description of each individual's appropriate related experience. Each erection engineer shall have experience in specific contract work related fields such as structural/mechanical and electrical controls. Individual installation experience shall be a minimum of three successful field installations with at least one installation having been completed in the last two calendar year periods. The Contractor's erection engineering staff shall furnish installation assistance to the installation personnel, through the Contracting Officer, for the purposes of assuring the Government a proper receipt, inspection, handling, assembly, installation, operation, and

testing of complete sluice gates. The Contractor shall be responsible for furnishing 1 separate erection engineering service visit. The site visit is anticipated to last from one to three complete and consecutive work days (approximately 8 hours per work day). The site visits will be required for the field testing of the completed sluice gate installations. The Contractor's erection engineering staff shall be responsible for: identifying critical field measurements, procedures, and other concerns of quality; and maintaining records of each site installation visit. Copies of such shall be submitted to the Contracting Officer upon request.

3.5.4 Field Testing

3.5.4.1 Operational

Upon completion of the installation, each gate shall be lubricated and operated through as many cycles of opening and closing as may be necessary to demonstrate in the presence of the Contracting Officer proper functioning of the gates and that the units are free from binding or other defects.

3.5.4.2 Leakage

Upon completion of the field operational test, each gate shall be tested for leakage in the presence of the Contracting Officer. The Contractor shall provide all necessary temporary enclosures and sump pumps to fill the area on the upstream side to the design head as specified in PARAGRAPH: DESIGN. Seating and unseating heads shall be measured from the top water surface to the center of the gate. Leakage shall not exceed 0.2 gallons per minute per foot of gate opening perimeter.

3.6 OPERATION AND MAINTENANCE MANUALS

As specified in PARAGRAPH: SUBMITTALS.

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SECTION 15060

DISCHARGE PIPELINES

04/01

PART 1 GENERAL

1.1 SCOPE

This section covers discharge piping for the pumps at the K-12 pump station and at the L-1, L-2, K-7, and K-10 pump stations.

1.2 RELATED WORK OF OTHER SECTIONS

The following items are covered under other sections:

- (1) Pump work: SECTION 15161: ELECTRIC PUMPING EQUIPMENT.
- (2) Flap valves: SECTION 15100: VALVES.
- (3) Submittal Procedures: SECTION 01330: SUBMITTAL PROCEDURES

1.3 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 B1.1 | (1989) Unified Inch Screw Threads (UN and UNR Thread Form). |
| ANSI B16.5 | (1988) Pipe Flanges and Flanged Fittings. |
| ANSI B18.2.1 | (1981) Square and Hex Bolts and Screws Inch Series |
| ANSI B18.2.2 | (1987) Square and Hex Nuts (inch Series) |

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

- | | |
|-----------------|---|
| ASME Section IX | (1992) Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators. |
|-----------------|---|

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (1992) Structural Welding Code Steel.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C 104 (1990) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C 105/A21.5 Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems

AWWA C 110 (1987) Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. for Water and Other Liquids

AWWA C 111 (1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C 115 (1988) Flanged Ductile-Iron Pipe with Threaded Flanges

AWWA C 150 (1991) Thickness Design of Ductile-Iron Pipe

AWWA C 151 (1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

AWWA C 206 (1991) Field Welding of Steel Water Pipe

MANUFACTURER'S STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, INC. (MSS)

MSS SP-58 (1988) Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-69 (1991) Pipe Hangers and Supports - Selection and Application

MSS SP-89 (1991) Pipe Hangers and Supports - Fabrication and Installation Practices

1.4 SUBMITTALS

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

SD-01 Data

Coatings; GA

Data on the manufacturer's standard coatings for new valves, new pipes, and new fittings.

SD-04 Drawings

Materials and Equipment; GA.

Shop drawings shall be submitted for all materials and equipment. Components of the system shall be submitted together as a complete package.

Shop drawings shall include: manufacturer's descriptive and technical literature, performance charts, and catalog cuts; complete piping diagrams; details and data on equipment layout and anchorage, valves, couplings, and supports, anchors; and other details necessary to demonstrate that each proposed system has been coordinated and will properly function as a unit. Shop drawings shall show clearances needed for maintenance and operation. The following shop drawings shall be submitted:

(a) Shop drawings on the layout and installation of the pump discharge lines at the L-1, L-2, K-7, K-10, and K-12 pump station including sump pump discharge lines. The complete pump discharge piping system shall be shown on a scaled engineering drawing. A drawing of buried discharge lines between pump stations and gatewells shall also be shown on scaled engineering drawings with any required angular offset at mechanical joint fittings to achieve the desired routing. All support details, flexible couplings and anchors (including any welding details) shall be shown. All valves shall be shown.

(b) River crossing pipe shown

SD-09 Reports

Performance Test Reports; FIO

Upon completion, including testing, of each installed system, test reports shall be submitted in booklet form presenting all field tests performed. Performance test reports shall be included in the operation and maintenance manual specified in SECTION: 15161 ELECTRIC PUMPING EQUIPMENT.

SD-13 Certificates

Piping; GA

Certificates of compliance shall be submitted for piping.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

Pipe sizes shall be as shown. In general, pipe material shall be ductile iron with flanged joints or mechanical joint for fittings buried under ground. Materials and equipment shall be the standard products of manufacturers regularly engaged in the manufacture of such items. Items of

equipment shall essentially duplicate equipment that has been in satisfactory use at least 3 years prior to the contract award date.

2.1.1 Asbestos Prohibition

Asbestos and products containing asbestos shall not be used and will not be permitted on the contract work.

2.1.2 Verification of Dimensions

The Contractor shall be familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy prior to performing the work.

2.1.3 Welding Procedures

Welding details for piping supports and anchors (Materials and Equipment) shall be submitted for approval. Welding shall be performed in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME Section IX Boiler and Pressure Vessel Code, and/or AWS D1.1.

2.2 MATERIALS AND EQUIPMENT

2.2.1 Ductile Iron Pipe

AWWA C 150 and AWWA C 151, thickness class 53 for flanged piping. Pipe sizes shall be as indicated on the drawings. Certificates of compliance stating that Piping meets the specifications shall be submitted prior to installing the piping.

2.2.2 Fittings

Material, thickness, and pressure rating shall be Class 150. Linings, coatings, and wrappings shall be as specified for the pipe except hand applications may be used when machine application is not practicable. Fittings shall conform to AWWA C 110 and ANSI B16.5 as appropriate. Flanged end pipe shall be in accordance with AWWA C 115 Class 150. Flanges shall be ductile iron in accordance with AWWA C 110.

2.2.3 Mechanical Joints

High deflection mechanical joint couplings shall be used at all gatewell pipe connections as shown on the drawings. High deflection joints shall conform to ANSI/AWWA C153/A21.53. High deflection joints shall allow a 12-20 degree deflection angle over a 20 foot laying length depending on the pipe size. All other mechanical joints shall conform to AWWA C 111. Restrained mechanical joints shall allow a 3 - 5 degree deflection angle over an 18 foot laying length.

2.2.4 Protective Coatings and Linings

Pipes, fittings, and couplings shall be coated inside and coated outside

with a minimum 2 mil thickness (dry) asphaltic paint in accordance with AWWA C 151. In addition, buried lines shall have a polyethylene encasement applied and installed in accordance with AWWA C 105/A21.5. Minimum thickness shall be eight (8) mils. Manufacturer's data on the Coatings shall be submitted prior to installing coated items.

2.2.5 Bolts and Nuts

Size, length, and number of bolts and nuts for the pipe flanges shall be in accordance with AWWA C 110 and AWWA C 115. Bolts shall conform to ANSI B18.2.1 and nuts to ANSI B18.2.2. Threads shall conform to ANSI B1.1. "T" bolts used in restrained joint fittings shall be of stainless steel material.

2.2.6 Hangers, Inserts, and Supports

Shall be in accordance with MSS SP-58, MSS SP-69, and MSS SP-89.

2.2.7 Flexible Couplings

A sleeve type flexible coupling shall be furnished to be install on each buried discharge line approximately 5 feet outside the pump station wall. The sleeve coupling shall include a steel sleeve that fits over the D.I.P. pipe with each end closed by a gasket and follower made of malleable, ductile iron or steel. The gasket shall be a rubber compound that is compressed by action of the followers on the D.I.P. barrel. Bolts and nuts shall be high strength low alloy material meeting ASTM A 325 Type 3. The bolts shall be long enough to pass through both followers and gaskets when assembled on the sleeve ends. Bolts shall be tightened per the manufacturer's recommendation.

2.2.8 Annular Wall Seal

All wall and floor penetrations of discharge pipes shall incorporate a compressible ring seal system between the concrete opening and the discharge pipe. All concrete openings shall be sized per the seal manufacturer's recommendation for the size of pipe involved. The penetration of the 14" discharge lines at the K-12 pump station operation floor is the exception, utilizing a directly embedded pipe thimble. The annular ring system has modular seal rubber links that interlock and are compressed by outer plates made of a molded glass reinforced nylon. These plates on each end of a rubber seal stack transmit the compressive force of 316 fasteners and nuts into the seal assembly. Seal assemblies shall be similar or equal to Link Seal Modular Seals as manufactured by PSI/Thunderline/Link-Seal of Houston, TX.77021.

PART 3 EXECUTION

3.1 INSTALLATION

Flap valves, per SECTION 15100: VALVES, to be installed on the pump discharge lines at the end of all discharge lines at all pump stations. Install these valves at the discharge ends of the pipes as shown on the drawings with a flanged connection to the discharge pipe. Contractor to

supply and install fittings as required. Unless otherwise required, materials and equipment shall be installed in accordance with the manufacturer's written recommendations. The Contractor shall design and install all supports and anchors, as necessary, as submitted and approved.

3.1.1 Pipes and Fittings

Piping shall be carefully laid out in advance and unnecessary cutting of materials shall be avoided. Pipe openings shall be closed with caps or plugs during installation. Equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury.

3.1.2 Connecting Piping to Pumps

The Contractor shall lay out the pump discharge piping and connect to pump discharge shoes at the Pump Stations. Sump pump discharge piping shall also be located and installed as shown.

3.1.3 Assembly

Pipe ends shall be clean and free from indentations, projections, and roll marks. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service and conform to AWWA C 110 and AWWA C 115. Assembly of the flanged joints and mechanical joints shall be in accordance with the pipe manufacturer's standard method. After buried pipe is installed and before testing or backfill is placed, the coating shall be visually inspected for flaws and defects shall be repaired.

3.1.4 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. Squeeze type mechanical cutters shall not be used for ductile iron.

3.1.5 Welding

Field welding shall be in accordance with AWWA C 206. The names of qualified welders shall be furnished to the Contracting Officer prior to starting installation of welded piping.

3.2 TESTING

Miscellaneous piping at each pumping station shall be tested and inspected at the time of the pumping tests. If inspection or testing shows leaks or defects, such defective work or material shall be repaired or replaced as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Performance Test Reports shall be submitted upon the completion of each test.

3.2.1 Pressure Test

After the pipe is laid and the joints completed, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected to 1 hour to a hydrostatic pressure test of 30 psi. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, and valves shall be carefully examined during the test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, 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.

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SECTION 15100

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SECTION 15100

VALVES
04/01

PART 1 GENERAL

1.1 SCOPE

This section covers flaps and knife valves for all pump station pump discharge lines as shown.

1.2 REFERENCES

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

American National Standards Institute (ANSI)

| | |
|--------------|--|
| ANSI B1.1 | (1989) Unified Inch Screw Threads (UN and UNR Thread Form) |
| ANSI B16.5 | (1988) Pipe Flanges and Flanged Fittings |
| ANSI B18.2.1 | (1981) Square and Hex Bolts and Screws Inch Series |
| ANSI B18.2.2 | (1987) Square and Hex Nuts (inch Series) |

American Society for Testing and Materials (ASTM)

| | |
|------------|--|
| ASTM A 27 | (1993) Standard Specification for Steel Castings, Carbon, for General Application |
| ASTM A 126 | (1993) Standard Specifications for Gray Iron Casting for Valves |
| ASTM A 240 | (1995e) Standard Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip |
| ASTM A 536 | (1984) Ductile Iron Castings |
| ASTM B 98 | (1997) Specification for Copper-Silicon Alloy Rod, Bar, and Shapes |

AMERICAN WELDING SOCIETY (AWS)

| | |
|----------|--|
| AWS D1.1 | (2000) Structural Welding Code - Steel |
|----------|--|

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

Shop Drawings; GA.

Shop drawings shall be submitted for all materials and equipment. Components of the system shall be submitted together as a complete package. Shop drawings shall include: manufacturer's descriptive and technical literature, performance charts, and catalog cuts. The following shop drawings shall be submitted:

- a. Flap Valves for pump discharge lines. Submit mounting details.
- b. Knife valves for pump discharge lines and valve operators.
- c. Data on manufacturer's standard coating for new valves.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

Materials and equipment shall be the standard products of manufacturers regularly engaged in the manufacture of such items. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 3 years prior to the contract award date.

2.1.1 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type/style, model, serial number, and catalog number on a plate secured to the item of equipment. Nameplates shall be made of corrosion resisting metal with raised or depressed lettering on a contrasting colored background.

2.1.2 Instruction Plates

As necessary, each item of equipment shall be labeled with suitably installed instruction plates including warnings and cautions describing special and important procedures to be followed during starting, operating, and servicing of the equipment. The plates shall be made of corrosion resisting metal with raised or depressed lettering on a contrasting colored background.

2.1.3 Verification of Dimensions

The Contractor shall be familiar with all details of the work, verify all

dimensions in the field, and shall advise the Contracting Officer of any discrepancy prior to performing the work.

2.1.4 Welding Procedures

Welding details for piping supports shall be submitted for approval. Welding shall be performed in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code Section IX, and/or AWS D1.1.

2.2 MATERIALS AND EQUIPMENT

2.2.1 Not Used

2.2.2 Flap Valves for Pump Discharge Lines

Circular discharge flap valves shall be provided for flange mounting and pump discharge service on the ductile iron discharge lines. Each valve shall be able to withstand stresses resulting from static head on the face of the gate and the reaction forces from discharge through the gate. The valve body shall be ductile iron conforming to ASTM A 536, spherically dished, with flanged faced and drilled for ANSI B16.5 standard pipe flange. A resilient neoprene or Buna-N seat shall be bonded in a groove machined in the body. Hinge arms shall be high tensile bronze conforming to ASTM B 584 with silicon bronze pins conforming to ASTM B 98. Arms shall have two pivot points with adjustable lower pivot for limited rotation and a threaded upper hinge post for flap valve sensitivity. Spring bumpers shall be provided to prevent valves from opening more than 90 degrees. Lubrication fittings shall be provided at all bushings. Flap valves shall be similar to Rodney Hunt Series FV-AC as manufactured by Rodney Hunt Co., Orange, Massachusetts.

2.2.3 Not Used

2.2.4 Flap Valves for Underwater Immersion

Flap valves shall be furnished with the valve manufacturer's standard coating system for underwater.

2.2.5 Bolts And Nuts

Size, length, and number of bolts and nuts for the pipe flanges shall be in accordance with ANSI B16.5. Bolts shall conform to ANSI B18.2.1 and nuts to ANSI B18.2.2. Threads shall conform to ANSI B1.1.

2.2.6 Knife Valves

All pump station discharge lines shall incorporate a knife gate valve in the line as shown for emergency shut-off service. The valve shall be constructed of cast iron with stainless steel liners. A valve shall have raised faces and meet ANSI Class 125/150 flange faces. The knife gate shall be made from stainless steel with ground seating surfaces to insure long seal life. The valve shall be constructed in the wafer design to minimize

pipeline space. Valve packing shall be square braided high temperature flax suitable for temperatures to 220 degrees F. Valves shall meet ANSI B161.1 flange and flange fitting requirements. All valves shall be equipped with operating handwheels, unless shown otherwise. All valve sizes shall be as indicated for pump discharge line sizes.

2.2.6.1 Knife valve operating nut

For those 8" valves located below the pump station operating floor, the valve shall be provided with a 2" square operating nut. This nut shall be accessed through an opening in the floor to use a operating wrench of sufficient length to place the "T" head of valve handle at an operators waist when the operating nut is engaged by the wrench. One valve operating wrench shall be provided for each 8-inch valve.

2.2.6.2 Knife valve floor stand.

All 12" valves shall be furnished with floor stands to place the operating handwheel approximately 36" above the pump station operating floor. The floor stand shall include a position indicator. All required valve shaft extensions and couplings to connect the valve to the floor stand shall be provided

2.2.6.3 Knife valve floor stand/bevel gear operator.

The 16" valve required for use at the L-1 pump station shall be provided with a bevel-gear actuator mounted facing the pump access floor hatch. The floor stand shall be accurately located above the valve so that at least 1" of clearance exists between any part of the floor stand and the station masonry wall. If required shaft extensions and universal couplings shall be utilized between the valve body below the operating floor and the bevel gear floor stand operator

2.2.6.4 Floorstand Mounting Baseplates

A steel baseplate approximately 14" x 14" x 1/2" thick shall be placed over the concrete floor opening to mount the floorstands over each 12" or 16" knife valve.

PART 3 EXECUTION

3.1 INSTALLATION

Unless otherwise required, materials and equipment shall be installed in accordance with the manufacturer's written recommendations. Installation of the flap valves at the pump station discharges shall be coordinated with the pump discharge pipe installation. Contractor shall be responsible for providing any necessary supports and anchors for the valves.

3.1.1 Knife Valve Installation

All knife valves shall be installed in the discharge lines without creating distortion or stresses in the knife valve body. All floor stands shall be located above the valves so actuation by handwheels is smooth with no

binding or stiffness.

3.2 TESTING

Valves shall be operated, tested, and inspected at the time of the pumping and discharge pipe tests. If inspection or testing shows leaks or defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated.

3.2.1 Not Used

3.3 QUALITY CONTROL

The Contractor shall establish and maintain quality control for work under this section to assure compliance with contract requirements, and maintain records of Contractor's quality control for all construction operations. A copy of records of inspections and tests, as well as records of corrective actions taken, shall be furnished to the Government as directed by the Contracting Officer. The Quality Control Plan shall be in accordance with SECTION 01451: CONTRACTOR QUALITY CONTROL.

-- End of Section --

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SECTION 15161

ELECTRIC PUMPING EQUIPMENT (MODIFIED FOR PUMP INSTALLATION)

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SECTION 15161

ELECTRIC PUMPING EQUIPMENT
(MODIFIED FOR PUMP INSTALLATION)
04/01

PART 1 GENERAL

1.1 SCOPE

This section covers the installation of the electric submersible pumps at L-1, L-2, K-7, K-10, and K-12 pump stations as shown. A total of two or three pumps are required depending on the location. In addition, all five pump stations have one sump pump each.

1.2 RELATED WORK OF OTHER SECTIONS

The following items are covered under other sections.

- (1) Government Furnished Equipment: SECTION 01000: GENERAL
- (2) Discharge Piping: SECTION 15060: DISCHARGE PIPELINES
- (3) Submittal Procedures: SECTION 01330: SUBMITTAL PROCEDURES
- (4) Electrical requirements: SECTION 15000: POWER GENERATION EQUIPMENT

1.3 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 B4.1 | (1994) Preferred Limits and Fits for Cylindrical Parts |
| ANSI B16.5 | (1988) Pipe Flanges and Flanged Fittings |
| ANSI B17.1 | (1967, R1989) Keys and Keyseats |
| ANSI B46.1 | (1985) Surface Texture (Surface Roughness, Waviness and Lay) |

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

| | |
|-----------|--|
| ASTM A 27 | (1993) Steel Castings, Carbon, for General Application |
|-----------|--|

| | |
|------------|---|
| ASTM A 36 | (1994) Structural Steel |
| ASTM A 48 | (1994) Gray Iron Castings |
| ASTM A 108 | (1993) Steel Bars, Carbon, Cold Finished, Standard Quality |
| ASTM A 120 | (1994) Black and Hot-Dipped Zinc-Coated (Galvanized) Welded & Seamless Steel Pipe for Ordinary Uses. |
| ASTM A 193 | (1994) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service |
| ASTM A 194 | (1994) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service |
| ASTM A 276 | (1994) Stainless and Heat-Resisting Steel Bars and Shapes |
| ASTM A 285 | (1990) Pressure Vessel Plates, Carbon Steel, Low and Intermediate Tensile Strength |
| ASTM A 516 | (1990) Pressure Vessel Plates, Carbon Steel, for Moderate and Lower Temperature Service |
| ASTM A 564 | (1992A) Hot-Rolled and Cold-Finished Age-Hardening Stainless and Heat-Resisting Steel Bars and Shapes |
| ASTM A 576 | (1990B) Steel Bars, Carbon, Hot Rolled Special Quality |
| ASTM A 668 | (1991) Steel Forgings, Carbon and Alloy, for General Industrial Use |
| ASTM A 743 | (1992) Castings Iron -Chromium, Iron-Chromium-Nickel, Corrosion-Resistant, for General Use |
| ASTM B 98 | Specification for Copper-Silicon Alloy Rod, Bar, and Shapes |
| ASTM B 148 | (1992A) Aluminum-Bronze Sand Castings |
| ASTM B 584 | (1991A) Copper Alloy Sand Castings for General Applications |

1.4 SUBMITTALS

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

SD-04 Drawings

Pump Setting Drawings; GA

The Contractor shall submit pump setting plans and elevations for each size of pump in each pump station that indicates location of the access hatch and pump below in a pump bay with respect to discharge wall and proximity of any discharge pipe to frame (pump station K-12). The setting elevation drawing shall indicate the locations of access frame, pump discharge shoe, guide rail system, pump concrete support pedestal, sump floor, operation floor, discharge wall and monorail hoist pick point vertical centerline. In addition sump pumps will show plan and elevation of the sump pit on those drawings. These drawings will be reviewed and approved by the Contracting Officer's Representative before the Contractor begins any pump installation.

SD-06 Instructions

Installation and Erection; GA.

(1) Installation and Erection Instructions: The Contractor shall review printed and bound manuals describing the procedures for erecting, assembling, and installing the pumps and controls. These procedures will be followed by a pump installation contractor under the supervision of an erecting engineer. The manuals shall be submitted with any comments or questions at the time the pump shop drawings are reviewed.

(2) The installation description is a complete, orderly, step-by-step explanation of the various operations required to install each type of pump including the guide rails or cables and discharge shoe. It describes all special procedures and outlines special precautions. It includes such things as bolt torque values, permissible wear ring clearances, recommended instrument set-ups, recommended gages and instruments, bearing clearances, and similar details.

(3) The Description may be complemented and supplemented by contractor comments, drawings, sketches, photographs, and similar materials as necessary. The overall result shall be a description which may be comprehended by an engineer or mechanic without extensive experience in erecting or installing pumps of the type required.

(4) After review, the Government will furnish to the Contractor recommended comments and direction as necessary or desirable for the installation procedure and return two copies of the previously reviewed manual back to the Contractor. Differences of opinion between the Contractor, pump manufacturer, and Contracting Officer shall be reconciled in a manner mutually agreeable to all parties, and two

copies of the reviewed and annotated manual shall be submitted to the Contracting Officer's Representative. The final approved installation instructions shall be followed by the installation personnel for the completion of pump installation work.

SD-09 Reports

Test Results; FIO

Test results of field tests shall be submitted as specified in PARAGRAPH: FIELD TESTING.

SD-19 Operation and Maintenance Manuals

Operation and Maintenance Manual; GA

The Contractor shall review, prior to installation of any pumps to the project work site, a copy of the manual containing complete information in connection with the operation, lubrication, adjustment, routine and special maintenance, disassembly, repair, and reassembly of the pumps and accessories. The manual may include a listing of special tools required for working on the pumps and controls. The manual shall: incorporate complete information of the controls covered under this section and other pertinent electrical and mechanical sections; and include operation and maintenance procedures, special features, and instructions for setting all adjustable controls and equipment. Comprehensive as-installed drawings, photographs, field test results, and sketches of the pump installations shall be included.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

Pumps shall be installed at the pumping locations as shown. A total of two pumps shall be installed at locations L1, L2, and K-7. A total of three pumps shall be installed at locations K-10 and K-12.

2.1.1 Coordination

The Contractor shall install the controls required for the installation contract work. Electrical requirements are given in SECTION: 15000 POWER GENERATION EQUIPMENT. All pump shop drawings and control shop drawings shall be coordinated and all electrical and mechanical installation details submitted.

2.1.2 Nameplates

Each major item of equipment has the manufacturer's name, address, type/style, model, serial number, and catalog number on a plate secured to the item of equipment. Nameplates are made of corrosion resisting metal with raised or depressed lettering on a contrasting colored background. The Contractor shall review the nameplate data and report any discrepancies to the Contracting Officer.

2.1.3 Instruction Plates

As necessary, each item of equipment has been equipped with suitably installed instruction plates including warning and cautions describing special and important procedures to be followed while starting, operating and servicing the equipment. The plates are made of corrosion resisting metal with raised or depressed lettering on a contrasting colored background.

2.1.4 Verification of Dimensions

The Contractor shall be familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy prior to performing the work.

2.2 MATERIALS

Materials not specifically described shall, as far as practicable, conform to the latest approved industry standard(s) covering the appropriate class or types of materials.

2.2.1 Material Standards

Designated items shall conform to the following:

| Item | Requirements |
|-------------------------------|---|
| Cast Iron | ASTM A 48, Class No. 30A, 30B, and 30C |
| Cast Steel | ASTM A 27, Grade 65-35, annealed |
| Copper Alloy Castings | ASTM B 584, Alloy No. C93700 or C86300 |
| Structural Steel | ASTM A 36 |
| Cold Rolled Steel Bars | ASTM A 108, Minimum Working Strength 65,000 pounds per square inch |
| Hot Rolled Steel Bars | ASTM A 576, Grades: G10200, G10450, G1140 |
| Hot Rolled Stainless | ASTM A 564, Grade 517400 |
| Bars and Shapes: | |
| Steel Plates, Structural | ASTM A 285, Grade B |
| Steel Plates, Pressure Vessel | ASTM A 516, Grade 55 |
| Steel Forgings | ASTM A 668, Class F |

2.2.2 Pump Discharge Elbow

Pump discharge elbow has been furnished by the pump supplier. The discharge elbow is made of either cast iron or cast steel and consists of a flange for mating with the pump volute and discharge bowl. The discharge elbow has a cast iron shoe for anchoring to the sump floor. The seal between the pump volute and discharge shoe shall remain tight and intact under any pump thrust. No pump thrust will be induce on the guide rails.

2.2.3 Pump Access Hatches

The pump supplier has furnished the access hatches required for each pump. Covers (doors) are a minimum ¼" thick, extruded 6061 aluminum construction, and designed for incorporating the guiderail system for each pump. Covers

(doors) are double leaf design, rated for 300 pounds per square foot, and have diamond tread surfacing. Hatches are complete including framing, flush locking mechanism, handles and hardware. The frame is extruded aluminum, minimum $\frac{1}{4}$ " thick, with concrete anchors as part of the extrusion. All hardware shall be stainless steel. Covers have stainless steel hinges, complete heavy duty springs, and open to 90 degrees and lock automatically in the open position. Covers will close flush with the frame, resting on a $\frac{1}{2}$ " wide lip around the entire perimeter of the frame. A stainless steel safety chain is provided, attached to the cover leaves. The chain shall help prevent a person from falling into the wetwell when the hatch covers are open. Sump pump access hatches are designed for heavier loading and will take a 5000 lb. distributed load over the cover surface

2.2.4 Anchor Bolts

The Contractor shall furnish anchor bolts for each pump to be installed in this contract. The sizes and lengths shall be as recommended by the pump manufacturer with the anchor bolt and flat washer material to be stainless steel and the nuts shall be silicon bronze.

2.2.5 Guide Pipes

The Contractor shall furnish two galvanized steel guide pipes for each pump installed to use with the pump lifting system. Required size shall be 2" or 3" pipes (depending on pump size) that are continuous between attachment points at the access frame, discharge shoe and any intermediate supports as required. Pipe shall meet ASTM A 120 butt welded Schedule 40 material.

2.2.6 Pump Hoisting Chains

All pumps shall be furnished with stainless steel 316L chain with the following chain size and lengths for the capacity of pumps listed:

- 6000 GPM pump - $\frac{1}{2}$ inch chain diameter - minimum 12 feet chain/pump
- 3000 GPM pump - $\frac{5}{16}$ inch chain diameter - minimum 10 feet chain/pump
- 500 and 1000 GPM pump - $\frac{3}{16}$ inch chain diameter - minimum 16 feet chain/pump

All pumps shall be supplied with anchor or "D" shackles of cast or forged 316 stainless steel to accept the monorail hoist hook eye and the lifting hole or eye hook on the top of the pump motor casting. The Contracting Officer's Representative shall approve all chain, chain fittings and shortening of chain in the field after installation.

2.3 SPARE PARTS AND SPECIAL TOOLS

2.3.1 Inspection and Inventory

The Contractor shall inspect and inventory all special tools that are unique to the pump or control system for proper installation, testing, operation, and/or maintenance. Special tools shall be delivered when the pumps and controls are installed.

2.3.2 Spare Parts

All spare parts are the duplicates to the original parts furnished and are interchangeable with those parts.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 General

Installation of the new pumps shall be in accordance with the manufacturer's installation procedure as outlined in the approved installation manual. Contractor shall submit for approval the connection details of the 8" D.I.P. to the base flow/sump pumps. Base flow/sump pumps may be of either 500 gpm capacity (Stations L-2 & K-7) or 1000 gpm capacity (K12, L-1 & K-10). All of these pumps will be connected into an 8" D.I.P. discharge system as shown on the drawings.

3.1.1.1 Piping Layout

Storm water pumps are of 3000 gpm capacity (L2, & K-7 and K-10) or 6000 gpm capacity (K-12 and L-1). These pump sizes require 12" D.I.P. and 16" D.I.P. discharge lines, respectively. Due to the short discharge length and the close proximity of the discharge line to the access hatch at Station K-12, the discharge line size was reduced to 14" D.I.P. The Contractor shall furnish complete piping layouts with accurate discharge shoe dimensions for all pumping stations. The location of the 14" D.I.P. thimble shall be accurately determined with relation to the access hatch cover frame. The hatch cover interior edge will determine the discharge shoe location on the sump floor by virtue of the pump guide system. All concrete pedestals supporting the discharge shoes shall be sized and installed per the pump manufacturer's recommendations and submitted to the Contracting Officer's Representative for approval.

3.1.1.2 Access Hatches

3.1.1.2 Access Hatches shall be cleaned of any manufacturing residue and given a coating of bituminous sealer on embed surfaces before embedding in the concrete operating floor slab. The Contractor may elect to use a second pour or grout embedding of the hatch to structural floor slab. At three locations (L1, L2, & K-7), the Contractor will set an access hatch in the "1st" pump bay that contains the sump pump without a storm water pump in that pump bay. That access hatch will be placed at the exact same location from the rear wall and divider walls as pump bays #2 and #3.

3.1.1.3 Packaging, Marking, and Acceptance

The Contractor shall obtain the Government Furnished Pumping Equipment from a storage area in the Water Treatment Facility in Grand Forks, ND as specified in SECTION 01000: GENERAL. He shall inspect the pumps and control equipment after receipt to verify the equipment as completely wired as feasible and undamaged in order to minimize site installation work. The pumps and pump control equipment shall be uncrated carefully to prevent damage that would effect assembly and installation.

Within five calendar days after retrieval from the designated point of storage, the items shall be inspected by the Contractor. The inspection shall include an accounting of the items delivered and a visual inspection to determine any possible damage during handling. If this inspection reveals any defects or deviations from the contract requirements that could render the items unsuitable for the use intended, the Contractor shall notify the Contracting Officer's Representative and identify the deficiency(s).

3.1.1.4 Services of Pump Manufacturer's Erecting Engineer

An erection engineer, supplied under a contract with KSB Inc. and the Government, and regularly employed by this pump manufacturer shall inspect the submersible pump installation and determine the level of adherence to the approved installation instructions. The services shall be as designated in the supply contract and administered and monitored by the Contracting Officer's Representative. The services may include supervision of the setting of the discharge shoes, alignment and assembly of the pumps and the initial testing and operation of the pumps. The Contractor shall submit a request to the Contracting Officer's Representative for the presence of the erection engineer at least 14 calendar days in advance.

3.2 FIELD TESTING

3.2.1 General

All equipment shall be operated by the Contractor at his or her own expense to determine if joints leak and if the pumps have been properly erected and connected. Such testing shall be made at the direction of the Contracting Officer. The Contractor shall furnish all the electricity, and water required for the testing.

3.2.2 Field Testing

Field testing for the pump units shall be conducted within a reasonable time following completion of the equipment installation. The Contractor and Contracting Officer will jointly determine the date on which installation of the equipment is considered to have been completed to the extent that the testing can be performed. The testing shall thereafter proceed as expeditiously as practicable with all testing to be completed within 30 calendar days after the installation completion date.

3.2.3 Pump Testing

The submersible pumps shall be tested in the dry to determine whether they have been properly erected and connected. Such testing shall be made when and as directed. After the pumping units have been completely assembled, including all rotating elements, each unit shall be operated at full rated speed for two periods of 2 minutes in order to assure proper installation satisfactory operation. A ten-minute idle time between tests shall be provided. The Contractor shall conduct vibration measurements on all the pump units. Results of the pump testing shall be submitted to Contracting Officer.

3.2.3.1 Operating Condition Testing

All pumping units shall be run under operating conditions to insure that there are no leaks at any of the joints. Pumps shall be run under operating conditions for a total period of four hours. Should there be insufficient water to perform the testing, the Contracting Officer may at its option waive such testing. The Contractor shall demonstrate the removal and installation procedures of the submersible pumps by removing and then reinstalling them with any two pumps at each pump station utilizing the electric overhead monorail hoist.

3.2.4 Testing Submittal

The Contractor shall measure and submit the following: each motor total electrical power draw (in KVA) and each motor active electric power draw (in KW) for both the dry and wet testing; and the recorded actual operating revolutions per minute of each pump. Serial number, pump size, and the pump station name and location within the station shall identify all pumps when the pumps are tested.

-- End of Section --

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SECTION 15400

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SECTION 15400

PLUMBING

04/01

PART 1 GENERAL

1.1 SCOPE

Applicable provisions of Division 1 shall govern work under this section. The Contractor shall provide all items, articles, materials, operations or methods listed, mentioned or scheduled on the drawings and/or herein specified, including all materials, equipment, and incidentals necessary to produce a complete and operating system.

1.2 DESCRIPTION OF THE SYSTEM

- (1) Provide fixtures, specialties, equipment and all related piping as shown on floor plans, scheduled, and/or specified for a complete working system.
- (2) Provide all necessary sanitary waste, vent, and water piping, and ventilating as shown on floor plans, scheduled, and/or specified for a complete working system.
- (3) Provide electric water heater as shown on floor plans, schedule and/or specified.
- (4) Provide all sanitary waste and vent piping as shown from a point 5 feet outside building wall to all fixtures and/or appliances. Coordinate location and invert on sanitary sewer connection point to sewer line 5 feet outside building wall before proceeding with any work.
- (5) Provide all water piping as shown from a point 5 feet outside building wall to all fixtures and/or appliances.
- (6) All water piping shall be installed with pitch for seasonal drainage. This building is or seasonal use.
- (7) Contractor to properly instruct the Contracting Officer's Representative in the winterizing of the plumbing systems which includes the draining down water piping and removing water in service to meter, drainage of storage tank, and using RV anti-freeze. Winterize all traps by water removal and filling with RV anti-freeze.

1.3 REFERENCES

All work specified in this section and applicable provisions of Division 1

shall conform to all applicable codes and to the standards for materials and workmanship of the nationally recognized approval agencies and trade associations such as the American Society of Mechanical Engineers, the American Society for Testing and Materials, the American Standards Association, National Fire Protection Association.

1.4 SUBMITTALS

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

SD-04 Drawings

Shop Drawings; GA.

Shop drawings shall contain complete dimensional, operational, material quality and manufacturer information on all fixture, specialty and equipment items. The Contractor shall be responsible for transmitting copies of the approved shop drawings to the other affected trades. Shop drawings are required on the following items:

- (1) Fixtures and Trim
- (2) Drains and Cleanouts
- (3) Valves
- (4) Water Heater EWH-1
- (5) Storage Tank ST-1

1.5 GENERAL PROVISIONS

1.5.1 Drawings

(1) Plans of piping and fixtures shown on scale drawings, are diagrammatic only. They are intended to indicate size and/or capacity where stipulated, approximate location and/or direction and approximate general arrangement of one phase of work to another, but not to the exact detail or arrangement of construction. Plans are based on equipment scheduled. Contractor shall be responsible for changes resulting from equipment other than scheduled.

(2) If it is found before installation, that a more convenient, suitable or workable arrangement for any or all phases of the project would result by varying or altering the arrangement indicated on the drawings, Contractor may change the location or arrangement of his work without additional cost to the Government but only after obtaining a written approval by the Contracting Officer.

(3) Mechanical systems are shown on drawings that were closely coordinated with the Architectural drawings, however, minor variations may occur. Contractor shall verify dimensions, heights, door swings, and any other information critical to the placement of devices, with the architectural drawings to assure proper installation. Field measurements shall take precedence over drawing dimensions and shall be

verified. Plans shall not be scaled to locate equipment.

(4) All plumbing piping installations shall closely match the drawings as approved by the current Minnesota Plumbing Code. Any variation from or additions to the piping arrangement will require a revision or resubmittal to the Contracting Officer at the Contractor's expense.

1.5.2 Materials

(1) Each major component of the equipment shall have the manufacturer's name, address, catalog and serial number permanently attached in a conspicuous place.

(2) The same brand or manufacturer shall be used for each specific application of fixtures, pumps, valves, fittings, controls and other equipment.

(3) All materials shall be new and of the quality specified and meet approval as per current Minnesota Plumbing Code.

(4) All equipment shall be listed, approved or rated by a nationally recognized testing and rating bureau or the recognized manufacturers association responsible for setting industry standards. All electrical equipment and apparatus shall be U.L. listed. Examples of recognized associations are:

American Concrete Pipe Association
American Pipe Fitting Institute
American Water Works Association
Plastic Pipe Institute
Thermal Insulation Manufacturers Association

1.5.3 Equipment Substitutions

It is the intent of this specification to permit the use of the materials of any nationally recognized manufacturer so long as they are fully equal to the quality and performance of the named item in the opinion of the Contracting Officer. Materials or equipment of other manufacturers may be used upon the following conditions:

(1) The proposed substitute is equal in design, materials, construction and performance in the opinion of the Contracting Officer. No compromise in quality level will be allowed.

(2) The service capabilities, availability of service parts and stability of the manufacturer are adequate in the opinion of the Contracting Officer.

(3) The Contractor assumes responsibility for any modifications required for the installation of substitute equipment.

(4) Substitute equipment shall fit into the space provided with adequate provisions for service and maintenance and must meet product approval as per current Minnesota Plumbing Code. Any substitute

equipment that causes variation of or deviation from original piping arrangement may require a revision to be submitted to the Contracting Officer at the Contractor's expense.

1.5.3.1 Approval of Substitutions

Approval of materials and equipment will be by review and approval of project shop drawings.

PART 2 PRODUCTS

2.1 PIPING SYSTEMS

2.1.1 Exterior Water

Type "K" soft temper copper pipe with a working pressure of 150 psig at 73.4° F. and in accordance with ASTM B42 and ASTM B88 standards.

2.1.1.1 Fittings

(1) Wrot copper solder joint fittings in accordance with ANSI Std. B16.22; B16.29; B16.43.

(2) Cast copper alloy solder joint fittings in accordance with ANSI std. B16.18; B16.23; B16.26; B16.32

2.1.1.2 Soldered Joints

(1) Clean all surfaces per manufacturers installation recommendations.

(2) Apply non-toxic flux to all joint surfaces.

(3) Jointing shall be made with lead-free solder conforming to ASTM B32.

2.1.1.3 Pipe and Fittings

All pipe and fittings shall be installed per manufacturer's recommendations.

2.1.1.4 Valves for Water Service

Valves for Water Service shall have ends suited for proper installation in piping. Valves shall meet local standards or, in absence of such standards, the requirements below.

(1) Curb stop (3/4 inch thru 2 inch size) Minneapolis pattern H-15150 or H-15250 equal to Mueller Co. or McDonald.

(2) Curb Box. Minneapolis pattern base, cast iron extension type, 1 foot telescope length, 7'-0" length minimum, cast iron lid with plug.

2.1.1.5 Blow Out Tee

Provide and install curb box with water line blow out tee in main service

to building.

2.1.2 Interior Water

2.1.2.1 Piping Below Floor Slab

Type "K" soft temper copper with wrought copper solder joint fittings and jointing material shall be lead free solder and non-toxic flux.

2.1.2.2 Piping Above Floor

Type "L" hard tempered copper with wrought copper solder joint fittings and jointing material shall be lead free solder and non-toxic flux.

2.1.3 Exterior Sanitary Building Sewer

- (1) PVC Pipe (ASTM-D 3034) with rubber gasket joints (ASTM-D 3212)
- (2) Schedule 40 PVC (ASTM-D 2665) with solvent cement joints (ASTM-D 2564)
- (3) Fittings required shall meet specifications for respective piping.
- (4) Provide cleanouts as required per current Minnesota Plumbing Code.

2.1.4 Frost Protection - Sanitary Sewers

- (1) Piping shall be protected per current Minnesota Plumbing Code.
- (2) The insulation shall be built up with 1 inch extruded polystyrene insulation to required thickness with staggered joints.

2.1.5 Interior Sanitary and Vent

- (1) Cast iron no-hub pipe (CISPI-301) with mechanical sleeve joints (CISPI-310). Tyler pipe and fittings.
- (2) Galvanized steel pipe, above ground only, (ASTM-A53; ASTM-A120) with screwed or cast iron drainage pattern fittings.
- (3) Schedule 40 PVC pipe (ASTM-D2665) with socket solvent cemented joints (ASTM-D2855). PVC piping shall not run in air plenum ceilings, air shafts or ducts.
- (4) Fittings required shall meet specifications for respective piping.
- (5) Extend vents 12 inches above finished roof or above normal snow depth.
- (6) Provide approved roof flashing to correspond with roof covering being installed or with existing roof covering. Verify with roof installer so as to not void warranty of roof.

2.1.6 Horizontal Soil and Storm Lines

Lines shall pitch down a minimum of 1/8 inch per foot in the direction of flow, or as indicated on the drawings. Soil and waste branch piping shall pitch down 1/4 inch per foot. All vent piping shall drip back into waste piping. Stacks shall be run vertically. Changes of direction 45° or more from vertical to horizontal shall be made with long sweep elbows. Horizontal changes in direction shall be made with "Y" or "Y" and 1/8 bend combination fitting.

2.2 PIPE HANGERS

Furnish and install suitable hangers and supports for all horizontal lines.

Hangers and supports shall be Grinnell, Mason, F&M, Michigan or equal. Heavy pipes shall be carried by pipe hangers supported by rods secured to structure. No piping shall be hung from other piping or ductwork. In no case shall hangers be supported by means of vertical expansion bolts.

2.2.1 Support Spacing

Piping shall be supported at distances not to exceed those specified.

| Pipe Material | Maximum Horizontal Spacing (feet) | Maximum Vertical Spacing (feet) |
|--|--|--|
| Acrylonitrile Butadiene Styrene (ABS) | 4 | 10 |
| Brass | 10 | 10 |
| Cast Iron | 5a | 15 |
| Copper or Copper-Alloy Pipe | 12 | 10 |
| Copper or Copper-Alloy Tubing | | |
| < 1-1/4" diameter | 6 | 10 |
| ≥ 1-1/2" diameter | 10 | 10 |
| Chlorinated Polyvinyl Chloride (CPVC): | | |
| < 1" diameter | 3 | 5b |
| ≥ 1-1/4" diameter | 4 | 6b |
| Crosslinked Polyethylene (PEX) | 2-2/3 | 4 |
| Ductile Iron | 5a | 15 |
| Galvanized Steel | 12 | 15 |
| Lead | Continuous | 4 |
| Polybutylene (PB) | 2-2/3 | 4 |
| Polyvinyl Chloride | 4 | 10 |
| Stainless Steel | 12 | 15 |

Note a: The maximum horizontal spacing for supports may be increased to 10 feet when 10-foot lengths of pipe are employed.

Note b: Mid-story guide is to be employed.

Note c: " ≤ " means less than or equal to.
 " ≥ " means greater than or equal to.

2.3 VALVES

2.3.1 General

Provide all valves shown on the plans and as required by applicable state and local codes. Valves manufactured by Milwaukee, Nibco, Jomar, Watts or Apollo are acceptable. All valves shall be suitable for 125 PSIG working pressure unless otherwise specified.

2.3.2 Control Valve

A control valve for water supply piping 3/4 inches through 4 inches in diameter which serves 2 or more plumbing fixtures shall have a nominal diameter at least equal to the piping.

2.3.3 Hot and Cold Water

2.3.3.1 Ball Valves

4" and smaller. Two or three piece bronze body, full port, blow out proof stainless steel stem, brass ball with hard chrome plating, TFE seat rings,

plated steel handle.

2.3.3.2 Check Valves

3" and smaller. Bronze body horizontal swing, Buna-N disc, stainless steel pin and lever.

2.4 INSULATION

2.4.1 General

The work covered by this specification consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of all insulation for the plumbing piping systems. Insulation shall be installed in strict accordance with the insulation section of this specification and applicable drawings, subject to the terms and conditions of the contract. All insulation shall be installed in a workmanlike manner by skilled workmen regularly engaged in this type of work. Insulation shall be Johns-Manville, Armstrong, Fiberglass, Knauph, or products of equal quality and performance.

2.4.1.1 Fire and Smoke Hazard Ratings

All insulation shall have composite (insulation, jacket, or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM C84, NEPA 225, and UL 723 not exceeding: Flame spread 25; Smoke developed 50; fuel contributed 50; UL fire hazard classification 1. Accessories, such as adhesives, plastics, cements, taps or glass fabric for fittings shall be the same component ratings as listed above.

2.4.1.2 Thickness

Insulation thickness specified herein is based on a conductivity of .22 BTU/SQ.Ft/Deg. F/HR. at 75 degrees F. mean temperature. If insulating materials with substantially different thermal properties are used the thickness of insulation shall be adjusted to provide the overall insulating efficiency of the material specified.

2.4.1.3 Vapor Seal

Insulation on all cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vaporsealed to prevent condensation.

2.4.1.4 Openings

All insulation shall be continuous through walls and ceiling openings and sleeves where applicable.

2.4.1.5 Preformed Pipe Insulation

Preformed pipe insulation shall be two-piece or one-piece fiberglass

composite with vinyl coated embossed vapor barrier laminate and pressure sealing lap similar to Owens Corning's Fiberglass 25ASJ or Johns-Manville A.P. The insulation systems shall be suitable for piping operating between 50°F to 450°F. The insulation system shall be vermin-proof, rot-free, non-shrinking with a moisture absorption not exceeding .2% by volume after 96 hours at 120°F and 95% RH. Jacket permanence shall not exceed .2% perms and shall have a Beach puncture rating of at least 50 units.

2.4.1.6 Fittings, Valve Bodies, and Flanges

Fittings, valve bodies and flanges for pipe sizes 6 inch and smaller shall be finished with fiberglass inserts and PVC fitting covers. One (1) insert to be used for pipe insulation of 1 inch thickness. An additional insert to be used for each additional 1 inch or fraction thereof for pipe insulation above 1 inch thickness.

2.4.1.7 Pipe Expansion

Make adequate provisions for expansion of piping. Unions to be left uncovered and clean. Finished surfaces of insulation are to be suitable for painting.

2.4.2 Insulation Protection

2.4.2.1 High Moisture

Insulation exposed to high moisture of interior areas shall be encased with 15 mil. vinyl film.

2.4.2.2 Weather Exposure

Insulation exposed to weather shall be encased with 20 mil. vinyl film.

2.4.2.3 Joints

All joints sealed as recommended by manufacturer.

2.4.3 Domestic Water Piping

2.4.3.1 Cold Water Above Ground

Cold water above ground shall be insulated with 1 inch thick fiberglass insulation with ASJ jacket.

2.4.3.2 Hot Water Above Ground

Hot water above ground shall be insulated with 1 inch thick fiberglass for sizes through 3 inch pipe and 1-1/2 inch thick fiberglass for sizes greater than 3 inch and with ASJ jacket. See hot water maintenance systems recommendations.

2.4.3.3 Water Under Ground

Hot and cold water underground shall be insulated with 1/2 inch thick

plastic foam.

2.4.3.4 Concealed Water

Hot and cold water piping concealed in walls or pipe chases may be insulated with 1/2 inch thick plastic foam.

2.4.4 Water Storage Tank

All surfaces shall be insulated with three pound density fiberglass board equal to Owens Corning #703 using 2 inch thickness. Insulation shall be cut, scored or mitered to fit the contour of equipment with edges tightly butted and secured with #18 galvanized hexagonal mesh wire and heavy coat of mineral fiber cement over insulation. Finish with 6 oz. canvas jacket applied with suitable adhesive. This contractor shall provide insulation on equipment furnished by him only unless otherwise specified. Break insulation at access panels, handholes, equipment, joints, etc.

2.5 PLUMBING SPECIALTIES

2.5.1 Traps

Every fixture and floor drain shall be provided with a proper trap placed near the outlet and properly vented. Traps shall be cast iron hub and spigot where used in soil pipe or nohub with approved stainless steel couplings. Traps for threaded pipe shall be screwed drainage pattern cast iron "P" traps. Where approved, PVC traps with adjustable compression fittings may be used. All exposed traps for sinks, lavatories and similar fixtures shall be chrome plated "P" traps, or as specified with the fixture trim. All traps shall have a minimum seal of 2 inch.

2.5.2 Cleanouts - Floor

- (1) Based on product by Zurn
- (2) Cleanouts of equal quality by Wade, Sioux Chief, Josam or Ancon are acceptable.
- (3) Cleanout shall be set flush with floor.
- (4) Covers shall be round or square scoriated nickel bronze.
- (5) All cleanouts shall be full size of the pipe it serves thru 6" and 6" for sizes 8" and larger.
- (6) Cleanouts - Floor.

c.o. 1 Zurn Z-1400NH or NL, gasketed seal - bronze or PVC plug (light to medium traffic).

2.5.3 Cleanouts - Wall Access

- (1) Based on product by Sioux Chief Products Co.

(2) Wall access plates of equal quality by J.R. Smith, Wade, Josam, Ancon, and Zurn are acceptable.

(3) Wall access covers shall be heavy duty round stainless steel for size 5-1/2" diameter thru 8-1/2" diameter and standard duty round stainless steel for diameters 10-1/2" and 12-1/2".

(4) Each wall access cover shall be secured to wall by a tapped, behind the wall, bar and a chrome plated threaded bolt.

(5) Sioux Chief wall access covers #SS-1015 HD, SS-1016HD, SS-1018HD, SS-1010 and SS-1025.

2.5.4 Floor Drains

(1) Provide and install floor drains where shown and size indicated on the drawings of the type listed below. Floor drains shall be set level and at the proper elevation to drain the surrounding floor area. All floor drains set in floors above habitable space shall be equipped with 4# per square foot sheet lead safing or approved vinyl type extending a minimum of 18 inches beyond rim of floor drain in all directions. Based on product by Zurn.

Ventonite, Inc. - Atlanta, Georgia.

ACD Pourable Underlayment, International, Inc. - Pittsburgh, PA

Ardex V-800, Levelcrete by Ardex, Inc. - Pittsburgh, PA

Latex Cement by Master Builders/Martin Marretta - Cleveland, OH

FD-1 Floor Drain

Zurn ZN-415 w/Type B Strainer

Cast iron body, reversible clamping collar for high or low setting, round nickel bronze adjustable strainer. Strainer diameter shall be 5" for 2" outlets, 6" for 3" outlets thru 8" for 4" outlets.

Floor Drains of equal quality by Wade, Josam, Ancon or Smith are acceptable.

2.5.5 Water Hammer Arrestors

(1) Provide water hammer arrestors on hot and cold water piping where shown on drawings.

(2) Water hammer arrestors shall be sized and located in accord with the hydraulic design of the piping system served and to the manufacturer's recommendations.

(3) Mechanical water hammer arrestors shall be accessible.

(4) Arrestors manufactured by J.R. Smith, Wade, Josam, Zurn, Sioux Chief or Precision Plumbing Products are acceptable.

ARRESTOR SIZING TABLE

| P.D. I. Units | Fixture Units | Plan Symbol |
|---------------|---------------|-------------|
| A | 1-11 | "A" |
| B | 12-32 | "B" |
| C | 33-60 | "C" |
| D | 61-113 | "D" |
| E | 114-154 | "E" |
| F | 155-330 | "F" |

2.5.6 WH-1 Wall Hydrants

Provide and install where shown on the drawings Woodford Model #67 automatic draining freezeless wall hydrant with chrome plated finish, removable "T" handle key, vacuum breaker and anti-siphonage outlet (ASSE #1052). Seal hole through all around hydrant with grout or caulking to make water tight and air tight. Provide stop and waste valves in lines preceding all hydrants. Wall hydrants equal in quality by J.R. Smith, Josam, Wade or Zurn are acceptable.

2.5.7 Thermometers

Provide thermometers in water systems for monitoring system. Thermometers shall be industrial grade with 9 inch aluminum case, black finish, aluminum stems, 2-1/2 inch insertion, clear acrylic window, red indicator on white scale, and brass well socket. Thermometers shall be adjustable type with range as best suited to application. Mount thermometers in a position so as to be visible from a convenient floor location. Instruments shall be Trerice Series A005. Enrst Gauge Co. or Crosby are acceptable. Provide thermometers in the following locations:

1. Water heaters in hot building supply.

2.5.8 HB-1 Hose Bibb

Woodford Model 26, 3/4" chrome plated brass faucet with loose key handle and vacuum breaker (ASSE 1052) with 3/4" male hose thread, or equal product.

2.6 EQUIPMENT

2.6.1 Electric Water Heaters

See Schedule for size and characteristics. Heaters shall be glass lined steel, tested under 125 psi hydrostatic pressure prior to lining, and provided with anodic protection, external drain valve and ASME rated temperature and pressure relief valve. Heating elements shall be direct immersion type, heavy duty, Incoloy sheathed, low voltage density (75 watts per square inch) of capacity and arrangement as scheduled. Controls shall include contactors, adjustable thermostats and high limit thermostat (set point 205°F.). Tank shall be insulated with polyurethane foam insulation with a minimum R-value of 16. The entire unit shall be U.L. approved and labelled. Heater by Rheem, Lockinvar, A.O. Smith, or State Industries are acceptable.

2.6.2 Water Storage Tank

(Small Volume) Provide and install where shown on plans and as scheduled a carbon steel, cement lined, constructed, designed and stamped in accordance with ASME Code for working pressure of 125 psig as manufactured by Cemline, or equal. Provide pressure relief valve (see Schedule).

Also provide unions, ball valves bypass piping, pressure relief valve

set at 75 PSIG, and drain valve as per detail. Insulate exterior of pressure tank as per specifications.

2.6.3 Water Heater/Storage Tank Safety Devices

2.6.3.1 Storage Type Water Heaters and Tanks

All pressurized storage-type water heaters and unfired hot water storage tanks shall be equipped with one or more combination temperature and pressure relief valves. The temperature steam rating of a combination temperature and pressure relief valve or valves shall equal or exceed the energy input rating in BTU per hour of the water heater. No shut off valve or other restricting device may be installed between the water heater or storage tank and the combination temperature and pressure relief valve.

2.6.3.2 Non-Storage Type Water Heaters

All pressurized non-storage type water heaters shall be provided with a pressure relief valve installed at the hot water outlet with no shut off valve between the heater and the relief valve.

2.6.3.3 Temperature and Pressure Relief Valves

Temperature and pressure relief valves shall be installed so that the sensing element of the valve extends into the heater or tank and monitors the temperature in the top 6 inches of the heater or tank.

2.6.3.4 Relief Valve

- (1) Every relief valve which is designed to discharge water or steam shall be connected to a discharge pipe.
- (2) The discharge pipe and fittings shall have a diameter not less than the diameter of the relief valve outlet.
- (3) The discharge pipe may not be trapped.
- (4) No valve may be installed in the discharge pipe.
- (5) The discharge pipe shall be installed to drain by gravity flow to a floor served by a floor drain. The outlet of the discharge pipe shall terminate within 6 inches over the floor or receptor, but not less than a distance equal to twice the diameter of the outlet pipe. The outlet of the discharge pipe may not be threaded.
- (6) The discharge pipe for a water heater shall terminate within the same room or enclosure within which the water heater or hot water storage tank is located.

2.6.3.5 Safety Devices

- (1) Relief valves shall be listed by the American Gas Association, Underwriters Laboratories, Inc. or American Society of Mechanical Engineers when the heat input to a water heater is less than or equal

to 200,000 BTU per hour.

(2) Relief valves shall be listed by the American Society of Mechanical Engineers when the heat input to a water heater exceeds 200,000 BTU per hour.

(3) Pressure relief valves shall be set to open at either the maximum allowable working pressure rating of the water heater or storage tank or 150 psig, whichever is smaller.

(4) Temperature and pressure relief valves shall be set to open at a maximum of 210° F. and in accordance with subpar. f.3).

2.7 FIXTURES AND TRIM

This section of the work includes plumbing fixtures furnished and installed by the Contractor.

2.7.1 Vitreous China Fixtures

All vitreous china fixtures shall be of the best quality conforming in all respects to classification "Regulation Selection" in accord with the uniform grading rules of "Vitreous China". Fixtures to be "roughed-in" in accord with manufacturer's dimensions. All fixtures shown on the drawings and/or specified herein shall be set firm and true, connected to all the piping services required and ready for use without the offsetting of supplies. Equipment shall be suitably protected against damage before and after installation. Any damaged plumbing fixture or piece of equipment shall be replaced at the expense of the plumbing contractor. All fixtures to be acceptable for final inspection shall be free of chips, flaws, scratches, abrasions, discolorations or any defect which, in the opinion of the Contracting Officer would classify the fixture as unsuitable for use intended.

2.7.2 Exposed Trim

All exposed trim including pipe nipples to plumbing fixtures shall be chromium plated and shall be completely free of tool marks, abrasions, or flattening of tubing, etc. All fixtures included in this specification and shown on the drawings shall be completed by the plumbing contractor together with all necessary hangers, bolted, anchors and brackets.

2.7.3 Fixture Location

All fixture heights, spacing apart and distances from walls shall be in accordance with Architectural details (floor plans and elevation). Deviation may necessitate alteration to comply with plans. Verify dimensions with General Trades. All fixtures shall be set level.

2.7.4 Water Flow

Repair all leaks, dripping faucets, etc. Regulate flow to water closets, showers, etc., for proper operation. Provide shutoffs at all individual fixtures.

2.7.5 Fixtures and Trim

Fixtures and trim of equal quality as listed by other manufacturers may be submitted.

2.7.6 Fixture Support

Fixture support. Provide and install proper supports and carriers for plumbing fixtures as scheduled or required for the application. Carriers shall be set in accordance with manufacturer's recommendations with adequate anchors and fasteners to provide required support. Wall hung water closet outlets shall be fully grouted for support in masonry walls.

2.7.7 Caulk

Caulk around all plumbing fixtures.

2.8 PLUMBING FIXTURES

PLUMBING FIXTURES

WC-1 Water Closet (ADA)

Kohler K-4330

American Standard 2257.103

Crane 3-446E

Vitreous china elongated bowl siphon jet rear outlet water closet with top spud. Rim 18" A.F.F. Provide fixture carrier.

Flush Valve:

Sloan Regal 111 or Sloan

Royal Zurn Z-6000XL-WS1 or

Aquavantage

Delany 402-1

Exposed chrome plated flush valve for 1.6 gallon flush, quiet action with screw-driver stop, vacuum breaker, escutcheon and spud flange.

Seat:

Bemis No. 1955-C

Beneke 523

Kohler K-4670-C

Olsonite 10-CC

Extra heavy white solid plastic open front seat with check hinge for elongated bowl.

Carrier:

Zurn 1203/1204 Series

Wade

J.R. Smith

No hub, horizontal/vertical, siphon jet carrier. Right or left hand, double/single to be determined by Plumbing Contractor.

Note: As per ADA code, flush handle must be located on open accessible side of stall.

PLUMBING FIXTURES

WC-2 Water Closet

Kohler K-4330
 American Standard 2257.103
 Crane 3-446E

Vitreous china elongated bowl siphon jet rear outlet water closet with top spud. Rim 15" A.F.F. Provide fixture carrier.

Flush Valve:

Sloan Regal 111 or Sloan Royal
 Zurn Z-6000XL-WS1 or Aquavantage
 Delany 402-1

Exposed chrome plated flush valve for 1.6 gallon flush, quiet action with screw-driver stop, vacuum breaker, escutcheon and spud flange.

Seat:

Bemis No. 1955-C
 Beneke 523
 Kohler K-4670-C
 Olsonite 10-CC

Extra heavy white solid plastic open front seat with check hinge for elongated bowl.

Carrier:

Zurn 1203/1204 Series
 Wade
 J.R. Smith

No hub, horizontal/vertical, siphon jet carrier. Right or left hand, double/single to be determined by Plumbing Contractor.

U-1 Urinal (ADA)

Kohler K-4960-T
 American Standard 6501.010
 Crane 7-197E
 Mansfield 475 (Note: #410 not state approved, use #475)

Vitreous china, wall hung, washout urinal with 3/4" top spud and 2" outlet and removable beehive strainer.

Flush Valve:

Sloan Royal 186-1
 Zurn Z6003XL-WS1
 Delany 451-1

3/4" chrome plated level operated quiet action flush valve with vacuum breaker, 3/4" screwdriver operated angle stop and 1/2" supply pipe to the fixture with chrome plated cast brass escutcheon. One gallon flush maximum

Carrier:

Wade: W-452
 J.R. Smith 637

Floor mounted single carrier with hanger plate, steel upright and block bases.

Note: Mounting height at 17" AFF to rim of urinal fixture.

PLUMBING FIXTURES

L-1 Lavatory (ADA)

Integral with countertop

See SECTION 06200: FINISH CARPENTRY.

Faucet:

Zurn Z-86500
Chicago 802A-665

Chrome plated brass faucet, 4" spout, slow-closing metering cartridge handles, 0.25 G.P.M. vandal resistant with 4" centers. Easy adjustable cycle time, preset to 10 seconds at 80 psi. 1/2" coupling nuts for standard lavatory risers.

Drain:

EBC SG7WC
McGuire 155WC
Keeney 5700PC

Offset lavatory drain with perforated strainer with 1-1/4" tailpiece.

Supplies:

EBC LA-16
Brass Craft OCR-1912-AZC
McGuire 2165-CC

1/2" compression chrome plated cast brass angle stop with brass stem and wheel handle, chrome plated flexible copper tube riser and chrome escutcheon.

Trap:

EBC-TA140
McGuire 8902
Keeney 311XPC

1-1/4" x 1-1/2", 17 gauge, ground joint, polished chrome tube "P" trap and escutcheon.

Insulation Kit:

Truebro #102 w/105 Accessory
Brocar Products C500 RHS
McGuire PW 2000 WC

Handicap lavatory P-trap and angle valve assemblies shall be insulated with white color fully molded insulation kit.

SS-1 Service SinkE.L. Mustee 63M
Fiat MSB-2424
Zurn 24

24" x 24" x 10" deep resin bonded white with black accents one piece mop basin with 3" cast brass drain body, dome strainer/lint basket. Provide 3" neoprene gasket 3 place mop hanger, vinyl bumper guard and silicone sealant. Provide 12" x 24" stainless steel wall panels and seal around basin at top of basin and wall panels.

Faucet:

Zurn Z-841M1
Chicago 897
T&S Brass B-0667-POL
Kohler K-8904

Polished chrome plated brass exposed wall mount service sink faucet with threaded spout, pail hook, wall bracket and loose key or integral stops. Install Watts No. 8A chrome plated vacuum breaker on threaded spout. Provide 36" long hose kit. Install faucet at 36' AFF.

PLUMBING FIXTURES

DF-1 Drinking Fountain

Elkay EDFP-117-C

Halsey-Taylor OVL-II-SEBP

Haws 1114

Oasis MLFMRSL

Two level lead-free, wall mounted, stainless steel fountain with wall plate and safety bubbler.

Supply:

EBC VA-16

Brass Craft OCR-1412-AZC

1/2" compression chrome plated cast brass angle stop with brass stem, wheel handle and chrome escutcheon.

Trap:

EBC TA140

McGuire 8902

Keeney 311XPC

Chrome plated 1-1/4" x 1-1/2", 17 gauge ground joint "P" trap.

Note: Mounting heights (see Detail).

2.9 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS

This contractor shall rough-in and make final connections to all items of equipment as shown or scheduled. Equipment shall be unloaded, assembled and set in place by persons furnishing equipment. Rough-in drawings shall be furnished to the plumbing trade by the equipment supplier immediately after contract is let to assure proper rough-in locations.

PART 3 EXECUTION

3.1 Execution

3.1.1 Workmanship

All work shall be done by qualified licensed plumbers that are knowledgeable and experienced in the operations they are performing. Fabrications and installation methods, procedures and materials shall be in accordance with accepted industry practice and with the standard of manufacturing and contracting associations applicable to the work. All work shall be neatly done with special emphasis on the appearance of work exposed to view. All piping shall be run plumb and square unless otherwise required for a functional reason. Gradients of pitched lines shall be continuous.

3.1.2 Painting

Furnish all equipment completely finished unless specifically noted otherwise. Touch up all abrasions, nicks, scratches or other paint defects to restore equipment to its original condition. Severely marred equipment shall be factory refinished if so desired by Contracting Officer. Clean all surfaces to make them suitable for painting, on all equipment furnished, which are to be painted by other.

3.1.3 Excavation and Backfill

(1) Refer to Section 02200, Division 2 "Earthwork" which is

applicable; especially note references to "Site Information, Protection, Excavation, Unforeseen Obstacles, Filling and Grading, Compaction Tests, Disposal of Excess and Waste Materials, Dewatering, Etc.

(2) Contractor shall perform all excavation required for related underground piping inside building and for all exterior underground piping. Include all necessary clearing of excavated area, and all trenching, tunneling, sheet piling, shoring, underpinning, pumping, bailing, transportation of earth, fill and backfilling.

(3) Reference is made to the Working Drawings for subsurface soil data, contours, site conditions, etc.

(4) Excavate whatever material is encountered to depth required. Excavation shall extend one foot out from each side of pipe. Bottom of trench or excavation shall be level and solidly compacted to assure firm foundation.

(5) All excavated materials shall be removed from site or deposited as directed by the Contracting Officer.

(6) Protect excavation from caving or washing and erect necessary barricades, complying with regulations set forth in EM 385-1-1 Safety and Health Requirements Manual, U.S. Army Corps of Engineers.

(7) Lay all pipe in open trenches unless Contracting Officer gives written approval for tunneling. Trenches for sewers and water shall have a minimum of 8 feet of space between each service. All underground piping shall be supported on a bedding of sand or granular material at least 4 inches thick.

(8) Backfill with sand to one foot above top of piping and thoroughly compacted with earth free of cinders, stones and debris. Remove forms, shoring, etc., as backfill is placed. All backfilling under footings must be compacted within 8 feet of all footings.

(9) When running a pipe below a footing and parallel to it, same shall in all cases be at least one foot greater in distance away from footing than below its bottom. Where possible, run lines at center point between two parallel footings and maintain above mentioned distances at minimum. When running under a footing, disturb as little of the soil under footing as possible. Provide concrete fill under all footings where excavations wider than 18 inches are required.

(10) Backfilling shall not be placed until the work has been inspected, tested and approved.

(11) Concrete, asphalt or gravel paved areas, sidewalks, curb, gutters and lawn areas which are disturbed shall be replaced and restored to original condition by Contractor unless specifically stated to the contrary.

3.1.4 Cutting and Patching

Skilled tradesmen shall be employed to do cutting and patching. Each trade shall be responsible for cutting and patching new openings for their use, in existing or previously constructed walls, ceilings, floors, roofs, etc., unless otherwise designated. Provide personnel protection under coring operations in occupied areas. Submit methods of supporting and sealing floor sleeves for approval. Holes cut in roof and exterior wall shall be weatherproofed immediately. Provide temporary dust barriers for cutting operations in occupied spaces. Refer to Architectural drawings for lintels provided by General trades. When lintels are not indicated in other division of the work, they shall be provided by the trade requiring the opening. All piping penetrations through masonry structure shall be drilled or core drilled. All penetrations for access panels, etc. shall be saw cut before removal. Jack hammering without saw cutting is prohibited.

3.1.5 Access

All plumbing fixtures and/or equipment shall be located so that parts requiring service and/or adjustment, fixture traps and valves shall be readily accessible. Provide access doors or panels to make service convenient. Doors by Milcor or as per architectural specifications.

3.1.6 Equipment and Piping

Below 7'-6" above finished floor shall have a resilient material (foam rubber, etc.) attached to all potentially dangerous edges.

3.2 SLEEVES AND INSERTS

(1) At all fire rated penetrations only use UL listed, tested, and approved materials and methods.

(2) All pipes passing through masonry walls, floors, ceilings or partitions shall be provided with sleeves having internal diameters at least 1/4 inch greater than the outside diameter of uninsulated pipes and/or outside diameter of the insulation of insulated piping. Sleeves for pipes passing through fire rated floor slabs and fire rated walls shall be schedule 40 steel pipe extending 1 inch above the finished slab and sealed. If holes must be cut through finished construction they must be core drilled to avoid damage to construction. Exterior wall sleeves shall be caulked weathertight. Sleeves through equipment room also shall be filled with glass fiber insulation. Where chases are formed for passage of several pipes, they shall have a 1 inch high curb above finished slab and sealed. Whenever sleeves occur as penetrations of rated construction, the void space shall be sealed with U.L. rated foam sealant similar to Chase Foam, CTC PR855; 3M Fire Barrier Caulk CP25 and putty 303; Dow Corning Fire Stop 2000 or Specified Technologies, Inc. Spec Seal Firestop Products installed in strict accordance with the manufacturer's instructions. Use sealant thickness as required to provide the full fire protection rating of the structure. Insulation shall not pass through rated assemblies. Insulation shall butt tight against the rated assembly after the sealant is installed and inspected.

(3) Inserts in floor slabs shall be galvanized individual type with accommodation for removable nuts and threaded rods up to 3/4 inch diameter, permitting lateral adjustment. Any fastener in a beam shall be midway above the bottom of the beam.

(4) Piping that passes through outside walls below grade and above grade shall be permanently sealed with a water-tight rubber compression seal between the pipe and the sleeve equal to Link-Seal modular wall and casing seal as manufacturer by Thunderline Corporation. The pipe sleeve and seal must meet UL listed, tested, and approved materials and methods.

3.3 MOUNTING PADS

Floor mounted mechanical equipment shall be set on reinforced concrete pads 4 inches high and extending 4 inches beyond the equipment base on all sides. See drawings for specific requirements.

3.4 IDENTIFICATION

(1) Identify all mechanical equipment with nameplate bearing equipment name and number, using 1-1/2 inch white bakelite with 1/2 inch black letters permanently mounted in a conspicuous place. Use mechanical fasteners instead of adhesive to mount nameplates wherever possible.

(2) Each piping system furnished and installed shall be identified. The direction of flow shall be identified by means of stenciled legends and flow arrows. The marking shall be applied after all painting and cleaning of the piping and insulation is completed and before ceilings are installed. Marking shall be in accordance with EM 385-1-1 and ASME A 13.1 1996 "Scheme for Identification of Piping Systems".

(3) The legend and flow arrow shall be applied at all valve locations at all points where piping enters or leaves a wall, partition, bulkhead, cluster of piping, or similar obstruction and at approximately 30 foot intervals on pipe runs with at least one in each space or room. Color shall be black with stencils sized as follows: Over 2" - 1" high; 2" under - 1/2" high. The marking shall be located so as to be conspicuous and legible at all times from any reasonable point. Install markings before ceilings are installed.

(4) Valve Identification. Valve charts shall be provided for each piping system which shall identify each valve with a numbered 1-1/4 inch round brass metal tag, stating valve number, valve location and describe valve function. Upon completion of the project, provide two copies of each chart enclosed in a glass front metal frame and shall be mounted in the mechanical room in a place as directed by the Contracting Officer. Tags shall be attached with metal "S" hooks or by metal chain. Tags shall be equal to Seton #2960. Provide valve identification charts in each Government's service and maintenance manual. Identification Symbols as follows:

| | |
|-----|---------------------|
| DCW | Domestic Cold Water |
| DHW | Domestic Hot Water |

(5) Concealed Valves and Equipment Identification. All valves, controls, or other equipment requiring service located above removable ceilings, shall have the ceiling tile directly below identified with a colored tack inserted into the tile or a colored sticker applied to grid system designating a valve above.

3.5 ESCUTCHEONS

(1) Escutcheons shall be installed on all exposed pipes wherever they pass through floors, ceilings, walls, or partitions.

(2) Escutcheons for pipes passing through floors in unfinished areas shall be split hinged type designed to fit the pipe and to cover the projecting pipe sleeve. Escutcheons for pipes exposed to view in finished areas shall be chrome plated brass.

(3) Escutcheons shall be properly sized to fit snugly around the pipe and shall be sized to completely cover the wall or floor opening.

3.6 TESTS AND ADJUSTMENTS

The Contractor shall conduct tests of systems as required by codes, regulatory agencies and this specification. Tests shall be made with the medium and under pressure as stated in the test requirements. Notify the Contracting Officer and/or regulatory agencies prior to conducting tests. The Contractor shall complete the attached certification form and submit to the Contracting Officer when tests have been completed and include in O&M Manuals.

3.6.1 Tests

| Type of System | Gauge Pressures (lbs. per sq. inch, or vacuum in inches) | Test Medium |
|---|--|-------------|
| Building Sewers, Building Drains, All Branches, Vents and Stacks of Sanitary, Storm or Clear Water Piping Systems | Minimum of 10 foot head on each joint for a minimum of 15 minutes with no head loss. | Water |
| Water | Uniform gauge pressure of 3 psi for a minimum of 15 minutes without adding air. | Air |
| a) Service and Bldg. Distribution Piping. | 100 psi gauge pressure for a 2 hour period | Water |

(1) The pressure in pounds per square inch, or inches of vacuum,

gauge, are given as an initial pressure to be applied to lines being tested, together with test medium. Tests are to be applied for a minimum period of four (4) hours and until tests are complete. Final pressures at the end of test period may vary only by that caused by expansion of the test medium due to temperature changes.

(2) Check of systems during application of test pressures should include visual check for water medium leakage, soap bubble or similar for air and nitrogen medium.

3.6.1.1 Start Up of Piping Systems

Potable water system shall be cleaned and disinfected in accordance with state and local codes or in the absence of such codes shall be treated by accepted methods to provide a system free of harmful contaminants and acceptance to regulatory agencies. All lines shall be thoroughly flushed to remove dirt and construction debris.

3.7 REQUIREMENTS FOR SUBSTANTIAL COMPLETION

3.7.1 Cleaning Equipment and Premises

(1) Thoroughly clean all parts of the piping, valves and fixtures. Exposed parts which are to be painted shall be thoroughly cleaned of cement, plaster and other materials and all oil and grease spots removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.

(2) Remove all construction debris, excess materials and equipment.

(3) Caulk around all plumbing fixtures at walls and around base of water closets, service sinks, etc.

3.7.2 Operating and Maintenance Manuals

3.7.2.1 Manuals

The Contractor shall furnish to the Contracting Officer five operating manuals for furnished equipment. Information sheets shall be bound in standard 3-ring binders labeled to show the contractor's name, address, regular business phone number, emergency phone number and date. Operating manuals shall be submitted prior to completion of the work to allow time for review. The manual shall contain the following information:

(1) The Certification of Tests and Adjustments completed and signed.

(2) A list (keyed with identification numbers used) of each item of equipment, which required service giving the name of the item, model number, manufacturer's name and address and the name address and phone number of the nearest representative or authorized service organization.

- (3) A copy of the approved shop drawing for each item.
- (4) A complete operating and maintenance manual with parts listed, wiring diagrams, lubrication requirements, and service instructions for each major item including faucet and mixing valve repair.
- (5) Complete control diagrams with description of all operating sequences and control devices.
- (6) Properly executed and registered manufacturer's warranties.
- (7) A copy of valve chart.

3.7.2.2 Training

- (1) Provide a minimum of 2 hours training on operations of major equipment with Government maintenance staff.
- (2) Contractor to provide training on the proper methods of winterizing a seasonal building.

3.8 PENETRATIONS OF FIRE RESISTIVE ASSEMBLIES

Plumbing piping systems that penetrate fire rated assemblies shall be installed in accordance with current Minnesota Plumbing and HVAC Code and U.L. or current acceptable methods. Also refer to requirements for sleeves.

3.9 ATTACHMENTS

- (1) Certification of Tests and Adjustments - Plumbing

-- End of Section --

CERTIFICATION OF TESTS AND ADJUSTMENTS - PLUMBING

Plumbing Trade Name: _____

Project Name _____

Project Number _____

The Plumbing Trade named above certifies that the tests and adjustments indicated below have been completed in accordance with the specifications on the date indicated.

| TESTS | DATE |
|---|-------|
| Building Sewers, Building Drains, Branches, Vents and Stacks | _____ |
| Sanitary Waste and Vent | _____ |
| Water: | |
| 1) Building Service | _____ |
| 2) Building Distribution | _____ |
| Start-up of Piping System and Pumps | _____ |
| Flushing and Disinfection of Potable Water System | _____ |
| Training Government on Methods of Winterizing a Seasonal Building | _____ |

Contract _____

Signed By Plumbing Contractor _____

Date _____

Signed By Project Manager _____

Date _____

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-- End of Section Table of Contents --

SECTION 15500

HEATING AND VENTILATING SYSTEMS

04/01

PART 1 GENERAL

1.1 SCOPE

This section covers heating and ventilation systems, ductwork, dampers, and louvers for the pump control buildings and restrooms.

1.2 RELATED WORK OF OTHER SECTIONS

Refer to the following for work related to this section:

1.2.1 Pump Work

SECTION 15161: ELECTRIC PUMPING EQUIPMENT

1.2.2 Electrical Wiring

SECTION 16250: ELECTRICAL WORK

1.2.3 Louvers, dampers and ductwork

SECTION 15000: POWER GENERATION EQUIPMENT.

1.2.4 Restroom Equipment

SECTION 15400: PLUMBING.

1.3 REFERENCES

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

Air Moving and Conditioning Association Inc. (AMCA)

AMCA 210 (1985) Laboratory Methods of Testing Fans for Rating

American Society for Testing and Materials (ASTM)

ASTM A 167 (1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 525 (1993) Steel Sheet, Zinc-Coated

(Galvanized) by the Hot Dip Process

American Welding Society (AWS)

AWS D1.1 (1996) Structural Welding Code

National Fire Protection Association (NFPA)

NFPA 70 (1996) National Electrical Code (NEC)

Sheet Metal and Air-Conditioning Contractors' National Association
Inc. (SMACNA) Standards

SMACNA Duct Standards (1985) HVAC Duct Construction
Standards-Metal and Flexible

SMACNA Systems Testing (1983) HVAC Systems-Testing, Adjusting,
and Balancing

1.4 SUBMITTALS

Shop drawings shall be provided for all equipment and materials. Submittals shall include manufacturer's descriptive and technical literature, performance charts, and catalog cuts. Drawings shall indicate clearances required for maintenance and operation. The shop drawings listed below shall be submitted.

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

SD-01 Data

Heating Equipment Data; GA

Provide manufacturer's bulletins, catalog cuts, etc. on the heating equipment supplied under this contract. Rating, control information, physical dimensions, etc. shall be given.

SD-01 Data

Exhaust Fans Data; GA

Provide data on the exhaust fans to be supplied. Include information on horsepower, speed, air quantity, fan type sound power level, and wiring data. Show all installation information and procedures including roof curbs.

SD-01 Data

Louvers and Dampers Data; GA

Provide information on louvers, motorized dampers, and gravity dampers. Include size, rating, and material. Installation details for ductwork shall be provided. Include support details, size, and gauge. All louvers, motorized dampers, ductwork and controls associated with the engine generator shall be coordinated with the Government Furnished engine generator to verify the proper sizing of this equipment with the engine generator set to be installed. Computations that prove this sizing for air flow, free area and pressure drop shall be provided.

SD-01 Data

Spare Parts Data; FIO

Provide spare parts data. - The Contractor shall provide a list of recommended spares for all equipment supplied.

SD-04 Drawings

Heating and Ventilating Systems Drawings; GA

Provide shop drawings on the installation of the heating and ventilating systems. All support details shall be shown. Wiring diagrams for the unit heaters and fans shall be provided.

SD-09 Reports

Balancing Reports; FIO

Provide any balancing reports for the exhaust systems installed, if required.

SD-09 Reports

Performance Test Reports; FIO

Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing all field tests performed. Performance test reports shall be included in the operation and maintenance manual.

SD-19 Operation and Maintenance Manuals

Operating and Maintenance Instructions and Manuals; FIO

Operating and Maintenance Instructions. The Contractor shall incorporate all as-built and service information on heaters, fans, and dampers into the operation and maintenance manual specified in SECTION 15161: ELECTRIC PUMPING EQUIPMENT. This information shall be provided in a separate section in the manual. A supplement covering equipment installed in the restrooms shall be supplied for incorporation into the manual required in SECTION 15400 PLUMBING.

Operation and maintenance information shall include troubleshooting and diagnostic data, routine service information, wiring diagrams, and parts data. A source for parts and service shall be provided. A description and

write up of the control systems shall be included.

1.5 GENERAL REQUIREMENTS

1.5.1 General

The drawings indicate the extent and general arrangement of the heating and ventilating systems. Contractor shall be responsible for installing the system per applicable local codes.

1.5.2 Standard Procedures

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products. Heaters, exhaust, and dampers shall be from a standard catalog line distributed by the manufacturer.

1.5.3 Asbestos Prohibition

Asbestos and products containing asbestos shall not be used.

1.5.4 Nameplates

Each major 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. Plates shall be made of corrosion-resisting metal with raised or depressed lettering and contrasting background.

1.5.5 Instruction Plates

As necessary, each item of equipment shall be equipped with suitably located instruction plates, including warnings and cautions describing any special and important procedures to be followed in starting, operating, and servicing the equipment. Plates shall be made of corrosion-resisting metal with raised or depressed lettering and contrasting background.

1.5.6 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contraction Officer of any discrepancy before performing any work.

1.5.7 Underwriters Laboratory

Electrical appliances and equipment supplied shall meet the Underwriters Laboratory requirements regarding fire and casualty hazards. The label or listing by the Underwriters Laboratory will be accepted as proof of conforming with this requirement.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall meet the requirements of publications and requirements listed below and indicated on the schedules at the end of this section.

2.1.1 Fans

Fans shall be tested and rated in accordance with AMCA 210. Fans may be directly connected to the motor shaft or indirectly connected to the motor by means of a V-belt drive. V-belt drives shall be designed for not less than 150 percent of the connected driving capacity. Fan and motor assemblies shall be provided with vibration isolation supports.

2.1.1.1 Wall Mounted Exhaust Fans

Wall exhaust fans shall be of aluminum for housings and provided complete with mounting flanges for attachment to the wall. Exhaust fans shall be propeller type, with sizes to provide a minimum 3000 cfm for sump exhaust and 2100 cfm for operation room exhaust and of the location and configuration indicated on the drawings. Fans shall be constructed with motor isolated from the exhaust stream. Motor shall be rated for continuous duty. Wall mounted exhaust fans shall be similar or equal to Greenheck Industries, Schofield, WI 54476.

2.1.1.2 Exhaust Fans (Restroom)

1) Provide and install ducted exhaust fan with external bracing, and 12/5 roof pitch base. CFM rating of 100 shall be provided at a static pressure of .5 W.G.

2.1.2 Heaters

Heaters shall be rated as shown on the drawings and shall be UL approved. Housing shall be heavy gauge, cold-rolled steel with a factory baked enamel finish. Heaters shall be wall mounted. Heaters shall be similar or equal to Chromalox Model LUH-07-43-32 (pump stations) or LUH-05-21-34 (restrooms).

2.1.3 Thermostat

Unit heaters shall be controlled by a remote thermostat which is wall mounted as shown on the drawings. Thermostat for the unit heaters shall be line voltage, heavy duty with SPDT switch rate at 16.0 amps at 120 VAC and 40 to 90 degrees F temperature range.

2.1.4 Heater Controls

Controls for the heaters shall be in an isolated compartment with a hinged cover which provides full access for servicing. All heater and control wiring shall terminate in the control compartment. Complete wiring diagram shall be attached to the inside of the access cover. Controls for the heaters shall include all of the following:

2.1.4.1 3-Pole Contractor

Heavy duty, 3-pole contractor, which provides quiet, efficient operation.

2.1.4.2 Fan Delay Relay

Bi-metallic, snap action fan delay relay, which energizes the fan after the heating element reaches operating temperature. Relay shall de-energize the fan when the temperature returns to normal.

2.1.4.3 Thermal Cut-Out

Thermal cut-out to de-energize the heating element if it overheats and resets when the temperature returns to normal.

2.1.4.4 Control Transformer

Fused control transformer with 24 volt secondary.

2.1.5 Heating Element

Heating element shall be finned tubular steel and non-glowing.

2.1.6 Fan Motor

Fan motor shall be totally enclosed with thermal protector and sealed bearings.

2.1.7 Dampers

Dampers shall be parallel blade type, tight seal design. Frame shall be welded 12 gauge galvanized steel and blades shall be extruded aluminum in airfoil shape. The connection of the damper frame to the louver frame shall include a non-conductive gasket or spacer.

2.1.8 Ductwork

All ductwork shall be galvanized steel sheets. Sheet metal ductwork shall comply with SMACNA Duct Standards. All ductwork shall be substantially airtight with no audible leaks, no dust marks showing at the duct joints, connections to equipment and grilles.

2.1.8.1 General

All duct work and sheetmetal housings shall be fabricated of prime, lock forming quality galvanized steel sheets. Gauges of metal and methods of construction and assembly shall be in a neat, workmanlike manner with all ducts run straight, level, and plumb on adequate hangers and supports to prevent sagging.

2.1.8.2 Duct Insulation Materials (Restrooms)

Exhaust Air Ducts, Concealed in Attic

(1) Manville "Microlite" FSK fiberglass blanket or CertainTeed standard duct wrap, with vapor barrier finish jacket, adhered to duct exterior with insulation bonding adhesive with joints lapped and sealed with pressure sensitive tape for complete vapor barrier.

(2) Ductwork including round, shall be additionally secured at bottom with mechanical fasteners, 16 inches o.c.

(3) Thermal conductivity: 1-1/2# density = R-4.16/K-0.24 per inch, at 75° F. mean temperature.

2.1.9 Grilles (Restrooms)

Units shall be single deflection, galvanized steel construction.

2.1.9.1 Grilles and Diffusers

Grilles and diffusers shall be constructed with welded hairline joints and a high quality finish as scheduled. Screws and fasteners (except for mounting grille to walls) on the face of grilles are not acceptable.

2.1.9.2 Grille Data

Grille manufacturer shall make sufficient data on grille performance available to balancing contractor to permit him to properly make air volume adjustments with standard meters and tools.

2.1.9.3 Grilles

Grilles shall fit securely against surrounding surface and shall be fitted with sponge rubber gaskets to prevent streaking. All grilles in showers, toilets, kitchens and other high moisture areas shall be all aluminum construction.

2.1.9.4 Grille Manufacturer

4) Grilles shall be as manufactured by Krueger, Metal-Aire, Tuttle & Bailey, Price, Kee's, Nailor, Air Guide, Titus or Anemostat.

2.1.10 Steel Sheets

Steel sheets shall conform to ASTM A 525.

2.1.11 Louvers

Louvers shall be furnished for installation in walls as shown. Louvers shall be connected to dampers. Louvers shall be aluminum construction. Louvers shall be all extruded construction, .081 thickness minimum. Blades shall be extruded aluminum, parallel or opposed as required. Blade edges shall be designed to carry water off to integral jamb downspouts. Design of the louver shall prevent rainwater from entering the airstream. Louvers shall be furnished with a birdscreen. Louvers shall receive

electrolytically deposited color anodized finish complying with Aluminum Association AA-C22A44. Finish is applied to 0.7 mils (.018) minimum thickness onto chemically etched and pretreated aluminum extrusions. Color shall be selected by the Contracting Officer from manufacturer's standard colors.

2.1.12 Air Quality Monitoring System

The Contractor shall furnish an Air Quality Monitoring System for use at any of the wet wells of the five pump stations. The Air Quality Monitoring System shall be a portable combustible gas and oxygen detector, nickel-cadmium rechargeable battery powered, and packaged for outdoor use. The unit shall indicate oxygen partial pressure from 15.00% to 25.00 % with plus or minus 0.25% resolution on the readout meter. An oxygen content alarm shall be factory preset to sound at the OSHA oxygen limits (19.58% low O₂ and 22.0% high O₂) and shall have adjustable alarm thresholds in at least 0.5% increments. The monitor system shall also test for OSHA compliance of at least the following gases: CO (carbon monoxide), NO₂ (nitrogen dioxide), H₂S (hydrogen sulfide), and CH₄ (methane). The Monitor System shall be capable of continuous monitoring for each gas, factory preset to alarm when the OSHA 1926.55 threshold is exceeded. Gage shall be scaled to read "percent lower explosion limit" (0% to 100%) scale. The system shall also be capable of separately detecting hydrogen sulfide gas in volumetric terms "parts per million" (PPM) within the minimum detection range 1 PPM to 40 PPM with adjustable alarm within the range. The alarm signal shall be loud audible (90+ dB at 50 foot "A" fast response, per SAE J919), as well as visual indicator lamp on the meter(s). Also included with the system shall be all the equipment required for meter calibration including pressure vessels with the required calibration gas, any special tools and parts, and complete instructions.

2.1.13 Air Ventilation Blowers

The Contractor shall furnish two portable air ventilation blowers for use primarily at pump station wetwell. Each blower shall be 480 volt AC powered adjustable air flow to at least 5300 CFM and shall come with a flexible waterproof outlet duct of at least 16 inch diameter in size and in two 10 foot long connectable section with splicing sleeve and connecting clamps. Each blower shall be mounted on a wheeled dolly and weigh not more than 90 pounds. Each blower motor, power cord, and electrical plug connector shall meet the requirements of SECTION 16415: ELECTRICAL WORK, INTERIOR. Each blower shall be equipped with a 50 foot extension cord detachable at blower with same disconnect at plug outlet. Each blower shall be weather proof to run unaffected in rain with NEMA 4 junctions and 3 phase TEFC motor. Each blower and base should be similar to "Coppus TA-16" as manufactured by Coppus Engineering Corp., Worcester, Massachusetts, 01615-3999.

PART 3 EXECUTION

3.1 INSTALLATION

Unless otherwise indicated or specified, all materials and equipment shall be installed in accordance with the manufacturer's recommendations.

3.1.1 Ductwork

All ductwork shall be installed in accordance with SMACNA Duct Standards. Ducts shall be secured and anchored to the building structures and shall be fabricated and installed in such a manner to prevent vibration under operating conditions.

3.1.2 Unit Heaters

Unit heaters shall be wall mounted as shown on the drawings. Thermostats shall be installed in accordance with the manufacturer's recommendation and located as shown on the drawings.

3.1.3 Electrical Work

Electrical work shall comply with NFPA 70 (NEC). Electric heaters specified herein shall be provided complete with motor and controls. Exhaust fans shall be provided with separate motor starters and disconnects mounted on the fan.

3.2 TESTING

Heating and ventilating systems specified under this section shall be tested and inspected at the time of the pumping tests. If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. The ventilation fan for restrooms shall be tested and inspected at the time of inspection of those structures.

3.2.1 Fans

The speed and direction of rotation of all fans shall be checked and verified. Motor current shall be measured. All ventilation system shall be operated for a period of not less than 15 minutes.

3.2.2 Heaters

All the heaters shall be operated for a period of not less than 15 minutes. Current draw shall be measured.

3.2.3 Louvers and Motorized Damper Function

3.2.3 Louver and motorized damper function - As part of the testing specified in Section 15000: Power Generation Equipment, louvers and dampers shall be tested for air flow profile, quantity with inlet and discharge air temperatures. Ambient outside temperature and interior temperature within the pump station at four locations shall be measured.

3.2.4 Ductwork

3.2.3 Ductwork shall be leak tested in accordance with SMACNA Duct Standards. Contractor shall conduct balancing test on all exhaust systems. Flow rates shall be within 10% of that shown on the drawings.

3.3 Attachments

- (1) HVAC Schedule
- (2) Control Schematics

-- End of Section --