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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION 35 20 16.39

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01/08

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SECTION 35 20 16.39

SECTOR GATES
01/08

****
NOTE: This guide specification covers the requirements for the fabrication, assembly, delivery, and installation of sector gates and appurtenant items. This section was originally developed for USACE Civil Works projects.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

PART 1 GENERAL

1.1 UNIT PRICES

****
NOTE: If Section 01 20 00 PRICE AND PAYMENT PROCEDURES is included in the project specifications, this paragraph title (UNIT PRICES) should be deleted from this section and the remaining appropriately edited subparagraphs below should be inserted into Section 01 20 00.

Select Alternate 1 (one pay item) or Alternate 2 (two pay items). Delete all paragraphs of Alternate not selected.
****

1.1.1 Furnishing and Installing Sector Gates and Appurtenant Items

****
NOTE: Alternate 1.
****

1.1.1.1 Payment

Payment will be made for costs associated with furnishing and installing sector gates and appurtenant items, which includes full compensation for the materials, fabrication, delivery, installation, and testing of sector gates and appurtenant items including gate leaves, pintle assemblies, hinge assemblies, seal assemblies, [walkways,] [bridgeways,] bumpers, fenders, and other items necessary for complete installation.

1.1.1.2 Unit of Measure

Unit of measure: lump sum.

1.1.2 Furnishing Sector Gates and Appurtenant Items

****
NOTE: Alternate 2.
****

1.1.2.1 Payment

Payment will be made for all costs associated with furnishing sector gates and appurtenant items, which includes full compensation for the materials, fabrication, and delivery of sector gates and appurtenant items including gate leaves, pintle assemblies, hinge assemblies, seal assemblies, [walkways,] [bridgeways,] bumpers, fenders, and other items necessary for complete installation.

1.1.2.2 Unit of Measure

Unit of Measure: lump sum.

1.1.3 Installing Sector Gates and Appurtenant Items

****
NOTE: Alternate 2.
****

1.1.3.1 Payment

Payment will be made for costs associated with the installation of sector gates and appurtenant items, which includes full compensation for the complete installation and testing of sector gates and appurtenant items.

1.1.3.2 Unit of Measure

Unit of measure: lump sum.

1.2 REFERENCES

****
NOTE: This paragraph is used to list the

publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020) Structural Welding Code - Steel
AWS D1.2/D1.2M	(2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA P3	(2019) Standard for Creosote - Petroleum Oil Solution
AWPA U1	(2020) Use Category System: User Specification for Treated Wood

ASTM INTERNATIONAL (ASTM)

ASTM A27/A27M	(2020) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A148/A148M	(2020; E 2020) Standard Specification for Steel Castings, High Strength, for Structural Purposes
ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A240/A240M	(2020) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A276/A276M	(2017) Standard Specification for Stainless Steel Bars and Shapes
ASTM A307	(2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A320/A320M	(2017b) Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A325M	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)
ASTM A490	(2014a) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A490M	(2014a) Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A501/A501M	(2014) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A564/A564M	(2019) Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes
ASTM A572/A572M	(2018) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A588/A588M	(2019) Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance
ASTM A668/A668M	(2020a) Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
ASTM A722/A722M	(2015) Standard Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete

ASTM B22/B22M	(2017) Standard Specification for Bronze Castings for Bridges and Turntables
ASTM B148	(2014) Standard Specification for Aluminum-Bronze Sand Castings
ASTM D395	(2016; E 2017) Standard Test Methods for Rubber Property - Compression Set
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D413	(1998; R 2017) Standard Test Methods for Rubber Property - Adhesion to Flexible Substrate
ASTM D471	(2016a) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D572	(2004; R 2019) Rubber Deterioration by Heat and Oxygen
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PS 9.01	(1982; E 2004) Cold-Applied Asphalt Mastic Painting System with Extra-Thick Film

1.3 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G[, [_____]]

SD-03 Product Data

Materials

Pintle Base Anchor Frame

Pintle Base

Hinge Assembly Embedded Anchorages

Welding; G[, [_____]]

SD-04 Samples

Materials; G[, [_____]]

Manufactured Units; G[, [_____]]

Fabrications; G[, [_____]]

SD-06 Test Reports

Tests, Inspections, and Verifications

1.4 QUALITY ASSURANCE

1.4.1 Qualification of Welders

Provide qualification of welders and welding operators conforming to the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

1.4.2 Detail Drawings

Provide detail drawings, including fabrication drawings, shop assembly drawings, delivery drawings, and field installation drawings, conforming to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

1.4.2.1 Fabrication Drawings

Provide fabrication drawings showing complete details of materials, tolerances, connections, and proposed welding sequences which clearly differentiate shop welds and field welds.

1.4.2.2 Shop Assembly Drawings

Provide shop assembly drawings showing details for connecting the adjoining fabricated components in the shop to assure satisfactory field installation.

1.4.2.3 Delivery Drawings

Provide delivery drawings showing descriptions of methods of delivering components to the site, including details for supporting fabricated components during shipping to prevent distortion or other damages.

1.4.2.4 Field Installation Drawings

Provide field installation drawings showing a detailed description of the field installation procedures. The description shall include the location and method of support of installation and handling equipment; provisions to be taken to protect concrete and other work during installation; method of maintaining components in correct alignment; plan for prestressing hinge bracket anchors, which shall include descriptions of connections, riggings, anchorages, and measuring equipment; methods for installing pintle and hinge assemblies, including checking and maintaining alignments during concreting; and methods for installing other appurtenant items.

1.5 DELIVERY, STORAGE, AND HANDLING

Provide delivery, handling, and storage of materials and fabricated items as described below.

1.5.1 Materials and Fabricated Items

Delivery, handling, and storage of materials and fabricated items shall conform to the requirements specified[and] in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.[Materials and equipment delivered to the site by the Contracting Officer shall be unloaded by the Contractor. Verify the condition and quantity of the items delivered by the Contracting Officer and acknowledge receipt and condition thereof in writing to the Contracting Officer. If delivered items are damaged or a shortage is determined, notify the Contracting Officer of such in writing within 24 hours after delivery.]

1.5.2 Rubber Seals

Store rubber seals in a place which permits free circulation of air, maintains a temperature of 20 degrees C 70 degrees F or less, and prevents the rubber from being exposed to the direct rays of the sun. Keep rubber seals 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

Submit system of identification which shows the disposition of specific lots of approved materials and fabricated items in the work, before completion of the contract; and materials orders, materials lists, and materials shipping bills in conformance with the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.1.1 Metals

Structural steel, steel forgings, steel castings, stainless steel, bronze, aluminum-bronze, and other metal materials used for fabrication shall conform to the requirements shown and specified herein and in Section 05 50 15 CIVIL WORKS FABRICATIONS.

2.1.1.1 Structural Steel Shapes

ASTM A36/A36M.

2.1.1.2 Structural Steel Plates

[ASTM A36/A36M,] [ASTM A572/A572M, Grade 50,] [or] [ASTM A588/A588M, Grade 50].

2.1.1.3 Steel Pipe

[ASTM A53/A53M, Type S, Grade B, seamless, black, normal size and weight class or outside diameter and nominal wall thickness as shown, [plain] [threaded] [threaded and coupled] ends.] [ASTM A501/A501M, seamless, outside diameter and nominal wall thickness as shown.]

2.1.1.4 Steel Castings

ASTM A27/A27M, Grade [_____], Class [_____]; or ASTM A148/A148M, Grade [_____].

2.1.1.5 Steel Forgings

ASTM A668/A668M, Class [_____], carbon content not exceeding 0.35 percent, and chemical composition which results in satisfactory weldability.

2.1.1.6 High-Strength Steel Bar

ASTM A722/A722M, Type [_____], and complying with all supplementary requirements.

2.1.1.7 Stainless Steel Bars and Shapes

ASTM A276/A276M, UNS [S 20910,] [S 30400,] [S 40500,] Condition A, hot-finished or cold-finished, Class C; or ASTM A564/A564M, UNS [S 17400,] [S 45000,] Condition A, age-hardened heat treatment, hot-finished or cold-finished, Class C.

2.1.1.8 Stainless Steel Plate, Sheet, and Strip

ASTM A167, UNS S 30400; and ASTM A240/A240M, UNS [S 20910,] [S 30400,] [S 40500,]. Plate finish shall be hot-rolled, annealed or heat-treated, and

blast-cleaned or pickled. Sheet and strip finish shall be No. 1.

2.1.1.9 Bronze Castings

ASTM B22/B22M, Copper Alloy UNS No. C91300.

2.1.1.10 Aluminum-Bronze Castings

ASTM A148/A148M, Copper Alloy UNS No. [_____].

2.1.2 Rubber Seals

****
NOTE: If fluorocarbon (Teflon) clad seals are not used, delete paragraph FABRICATION.
****

Rubber seals shall be [fluorocarbon (Teflon) clad rubber seals of the mold type only, shall be] compounded of natural rubber, synthetic polyisoprene, or a blend of both, and shall contain reinforcing carbon black, zinc oxide, accelerators, antioxidants, vulcanizing agents, and plasticizers.

2.1.2.1 Physical Characteristics

Physical characteristics of the seals shall meet the following requirements:

PHYSICAL TEST	TEST VALUE	TEST METHOD SPECIFICATION
Tensile Strength	17.2 MPa2500 psi (min.)	ASTM D412
Elongation at Break	450 percent (min.)	ASTM D412
300 percent Modulus	6.2 MPa900 psi (min.)	ASTM D412
Durometer Hardness (Shore Type A)	60 to 70	ASTM D2240
*Water Absorption	5 percent by weight (max.)	ASTM D471
Compression Set	30 percent (max.)	ASTM D395
Tensile Strength (after aging 48 hrs)	80 percent tensile strength (min.)	ASTM D572

The "Water Absorption" test shall be performed with distilled water. The washed specimen shall be blotted dry with filter paper or other absorbent material and suspended by means of small glass rods in the oven at a temperature of 70 degrees C plus or minus 2 degrees for 22 plus or minus 1/4 hour. The specimen shall be removed, allowed to cool to room temperature in air, and weighed. The weight shall be recorded to the nearest 1 mg as M subscript 1 (M subscript 1 is defined in ASTM D471). The immersion temperature shall be 70 degrees C plus or minus one (1) degree and the duration of immersion shall be 166 hours.

2.1.2.2 [Fabrication

Rubber seals shall have a fluorocarbon film vulcanized and bonded to the

sealing surface of the bulb. The film shall be [0.762] [1.524] mm[0.030] [0.060] inch thick Huntington Abrasion Resistant Fluorocarbon Film No. 4508, or equal, and shall have the following physical properties:

Tensile strength	13.8 MPa2,000 psi (min.)
Elongation	250 percent (min.)

The outside surface of the bonded film shall be flush with the surface of the rubber seal and shall be free of adhering or bonded rubber. Strips and corner seals shall be molded in lengths suitable for obtaining the finish lengths shown and with sufficient excess length to provide test specimens for testing the adequacy of the adhesion bond between the film and bulb of the seal. At one end of each strip or corner seal to be tested, the fluorocarbon film shall be masked during bonding to prevent a bond for a length sufficient to hold the film securely during testing.]

2.1.3 Bumpers and Fenders

[Bumpers and fenders shall be "Rubbumper," a product of Missouri Dry Dock & Repair Co., or an approved equal.] [Timber bumpers and fenders shall conform to [west coast fir] [or] [southern yellow pine], structural grade, dressed surfacing, pressure treated with creosote conforming to [AWPA P3] in accordance with AWPA U1. Bumpers and fenders shall be cut, beveled, or bored as required before being pressure treated.]

2.1.4 Asphalt Mastic

SSPC PS 9.01.

2.2 MANUFACTURED UNITS

Bolts, nuts, washers, screws and other manufactured units shall conform with the requirements shown and specified and in Section 05 50 15 CIVIL WORKS FABRICATIONS.

2.2.1 Bolts, Nuts and Washers

High-strength bolts, nuts, and washers shall conform to ASTM A325M ASTM A325, Type [_____], [hot-dip galvanized] or ASTM A490M ASTM A490, Type [_____]. Bolts, nuts, studs, stud bolts and bolting materials other than high-strength shall conform to ASTM A307, Grade A, [hot-dip galvanized] or ASTM A320/A320M, [Ferritic Steel, Grade [_____]] [Austenitic Steel, Grade [_____], Class [_____]]. Bolts M16 1/2 inch and larger shall have hexagon heads. The finished shank of bolts shall be long enough to provide full bearing. Washers for use with bolts shall conform to the requirements specified in the applicable specification for bolts.

2.2.2 Screws

Screws shall be of the type indicated on the drawings.

2.3 FABRICATION

2.3.1 Structural Fabrication

Structural fabrication shall conform with the requirements shown and

specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Components shall be shop-fabricated of the materials specified and shown. Dimensional tolerances shall be as specified and shown. Splices shall occur only where shown or approved. Pin holes shall be bored in components after welding, straightening, stress-relieving, and threading operations are completed. Brackets, eye bar sections, and other components requiring straightening shall be straightened by methods which will not damage the material. Bronze bushings shall be press-fitted with supporting components. Bolt connections, lugs, clips, or other pick-up assembly devices shall be provided for components as shown and required for proper assembly and installation. Provisions shall be made for the installation of appurtenances as required.

2.3.2 Welding

****
NOTE: List applicable welds requiring radiographic examination.
****

Welding shall conform with [AWS D1.1/D1.1M, AWS D1.2/D1.2M,] the requirements specified, and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Welds shall be of the type shown on the contract drawings and approved detail drawings. Radiographic examination is required on the major shop and field welds of the type and location indicated on the drawings and as follows: [_____]. Welds which have been designated to receive radiographic examination and are found to be inaccessible to a radiation source or film, or are otherwise so situated that radiographic examination is not feasible may be examined, with written approval of the Contracting Officer, by dye penetrant, magnetic particle tests, or ultrasonic tests. [Components shall be stress-relief heat treated after welding where shown. Stress-relieving of components shall be performed prior to the attachment of miscellaneous appurtenances.]

2.3.3 Bolted Connections

Bolted connections shall conform with the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.3.4 Machine Work

Machine work shall conform with the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.3.5 Miscellaneous Provisions

Miscellaneous provisions for fabrication shall conform with the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.3.6 Fabrications

Submit approved samples, prior to use of the represented materials or items in the work. Samples of standard and shop fabricated items shall be full size and complete as required for installation in the work. Approved samples may be installed in the work provided each sample is clearly identified and its location recorded. Fabrications shall conform to the following requirements.

2.3.6.1 Gate Leaf

Gate leaf shall be of welded fabrication except for bolted appurtenances. Gate leaf shall consist of a pintle socket, pipe column, and hinge pin housing integrally framed with horizontal and vertical trusses supporting vertical ribs faced with a continuous skin plate. Pintle socket shall be of cast steel conforming to ASTM A27/A27M. Pintle socket shall be press-fitted with bronze bushing conforming ASTM B22/B22M. Bearing surfaces of the bronze bushing shall have a truly hemispherical 0.4 micrometer 16 microinch finish. Pipe column shall conform to [ASTM A53/A53M] [ASTM A501/A501M]. Hinge pin housing shall be of [cast steel conforming to ASTM A27/A27M] [structural steel conforming to ASTM A36/A36M]. Trusses and vertical ribs shall be of structural steel conforming to ASTM A36/A36M. Skin plate shall conform to [ASTM A36/A36M] [ASTM A572/A572M, Grade 50,] [ASTM A588/A588M, Grade 50]. Gate leaf shall be shop-fabricated. Contractor proposed shop-fabrication of gate leaf in separate segments to facilitate handling and shipping must be approved and shall be as shown on approved detail drawings. Such segments shall permit easy field-assembly and shall be as few as practicable to minimize the number of joints to be field-welded. The overall height of the gate leaf shall not vary from the nominal dimension or differ from the mating gate leaf by more than 6 mm 1/4 inch. The surfaces of the vertical ribs to which skin plates are to be welded shall not vary from a true plane by more than 5 mm 3/16 inch. The outside surfaces of skin plates welded to the vertical ribs shall not vary from a true plane by more than 5 mm 3/16 inch. Splices in skin plates shall be located only where shown or approved. [In addition to welds specifically indicated on the drawings for nondestructive testing, [_____] percent of the welds in the [hinge pin housing] [joints between trusses and pintle socket] [joints between trusses and hinge pin housing] [joints between vertical webs and skin plate] [and] skin plate shall receive nondestructive testing. The location of these additional welds for testing shall be as directed by the Contracting Officer.] Gate leaf shall be provided complete with pintle assembly, hinge assembly, seal assembly, and other appurtenant components as required for complete installation as specified and shown.

2.3.6.2 Hinge Assembly

Hinge assembly shall consist of hinge bracket support anchor frame, hinge bracket support, hinge bracket, and hinge pin. Hinge bracket support anchor frame shall be a welded structural steel frame with high strength anchor bolts conforming to ASTM A722/A722M for prestressed anchorage of the hinge bracket support. Hinge bracket support and hinge bracket shall be of [cast steel conforming to ASTM A27/A27M] [structural steel conforming to ASTM A36/A36M]. The hinge pin barrel section of the hinge bracket shall be fitted with [a stainless steel collar conforming to ASTM A564/A564M and] [a bronze bushing conforming with ASTM B22/B22M] [an aluminum bronze bushing conforming to ASTM B148]. Hinge pin shall be of [forged steel conforming to ASTM A668/A668M] [stainless steel conforming to [ASTM A276/A276M] [ASTM A564/A564M]]. [In addition to welds specifically indicated on the drawings for nondestructive testing, [_____] percent of the welds in the hinge assembly components shall receive nondestructive testing. The location of these additional welds for testing shall be directed by the Contracting Officer.] [Welded hinge assembly components shall be stress-relieved by heat-treating after all welding is completed. Stress-relieving shall be performed prior to machining.]

2.3.6.3 Pintle Assembly

Pintle assembly shall consist of pintle base anchor frame, pintle base, pintle socket seal retainer ring assembly, pintle, and pintle socket which shall be an integral component of the gate leaf. Pintle base anchor frame shall be a welded structural steel frame [with high strength anchor bolts conforming to ASTM A722/A722M for prestressed anchorage of the pintle base]. Pintle base shall be of [cast steel conforming to ASTM A27/A27M] [structural steel conforming to ASTM A36/A36M]. Pintle shall be of [cast alloy steel] [forged alloy steel with bearing surfaces of corrosion-resisting steel deposited in weld passes to a thickness of not less than 3 mm 1/8 inch and machined the required shape]. The pintle ball pintle shall receive a 0.4 micrometer 16 microinchfinish and shall be fitted into the bushing of the pintle socket by scraping the bushing until uniform contact is attained over the entire bearing surface as determined by testing with carbon paper or other approved coloring. The pintle ball shall be match-marked with the bushing when fitted and so erected in the field.

2.3.6.4 Seal Assemblies

Seal assemblies shall consist of rubber seals, stainless steel retainer and spacer bars, and fasteners. Rubber seals shall be continuous over the full length. Seals shall be accurately fitted and drilled for proper installation. Bolt holes shall be drilled in the rubber seals by using prepared templates or the retainer bars as templates. Splices in seals shall be fully molded, develop a minimum tensile strength of 50 percent of the unspliced seal, and occur only at locations shown. All vulcanizing of splices shall be done in the shop. The vulcanized splices between molded corners and straight lengths shall be located as close to the corners as practicable. Splices shall be on a 45 degree bevel related to the "thickness" of the seal. The surfaces of finished splices shall be smooth and free of irregularities. Stainless steel retainer bars shall be field-spliced only where shown and shall be machine-finished after splicing.

2.3.6.5 Appurtenant Items

Seal plates, seal shapes, pintle socket seal retainer ring assembly, bumpers, fenders, [walkways,] [bridgeways,] and other appurtenant items shall conform to details specified and shown.

2.3.7 Shop Assembly

Shop assembly requirements for sector gates and appurtenant items shall be as shown and specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Sector gates and appurtenant items shall be assembled completely in the shop, unless otherwise approved, to assure satisfactory field installation. Adjoining components shall be fitted and bolted together to facilitate field connections. The matchmarking of unassembled items shall be carefully preserved until the items are assembled. Mating surfaces and machined surfaces shall be covered with a rust preventive until assembly. Assembled components shall be shop-welded in their final positions as much as delivery and field installation conditions will permit. Rubber seals shall be fitted and drilled to match the seal retainers, match-marked, and removed for shipment. Shop assembly and disassembly work shall be performed in the presence of the Contracting Officer unless otherwise approved. The presence of the Contracting Officer will not relieve the Contractor of any responsibility under this

contract.

2.4 TESTS, INSPECTIONS, AND VERIFICATIONS

Submit certified test reports for material tests, with all materials delivered to the site.

2.4.1 General

Tests, inspections, and verifications for materials shall conform to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

[2.4.2 Testing of Rubber Seals

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NOTE: If fluorocarbon (Teflon) clad seals are not used, delete this paragraph.
****

The fluorocarbon film of rubber seals shall be tested for adhesion bond in accordance with ASTM D413 using either the machine method or the deadweight method. A 25 mm 1 inch long piece of seal shall be cut from the end of the seal which has been masked and subjected to tension at an angle approximately 90 degrees to the rubber surface. There shall be no separation between the fluorocarbon film and the rubber when subjected to the following loads:

THICKNESS OF FLUOROCARBON FILM	MACHINE METHOD AT 50 MM2 INCHES PER MINUTE	DEADWEIGHT METHOD
1.524 mm0.030 inch	13.6 kg per 25 mm30 pounds per inch width	13.6 kg per 25 mm30 pounds per inch width
0.726 mm0.060 inch	13.6 kg per 25 mm30 pounds per inch width	13.6 kg per 25 mm30 pounds per inch width

]PART 3 EXECUTION

3.1 INSTALLATION

Perform installation in conformance with the requirements specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Sector gates and appurtenant items shall be assembled for installation in strict accordance with the contract drawings, approved installation drawings, and shop match-markings. Bearing surfaces requiring lubrication shall be thoroughly cleaned and lubricated with an approved lubricant before assembly and installation. Components to be field-welded shall be in correct alignment before welding is commenced.

3.1.1 Embedded Metals

Seal shapes, seal plates, frames, bases and other embedded metal items required for proper and complete installation shall be accurately installed to the alignment and grade required to ensure accurate fitting and matching of components. Embedded metals shall be given a primer coat of the required paint on all surfaces prior to installation in concrete forms. Anchors for embedded metals shall be installed as shown. Items requiring two concrete pours for installation shall be attached to the embedded anchors after the initial pour, adjusted to the proper alignment,

and concreted in place with the second pour. Welded field splices in sealing surfaces of embedded items shall be ground smooth.

3.1.2 Hinge Assembly Embedded Anchorages

Submit record of the prestressing of hinge bracket anchors immediately after completion of the prestressing operations. The hinge assembly embedded anchorages consisting of the hinge bracket support anchor frame and attached hinge bracket support anchor bolts shall be aligned accurately, leveled, and blocked rigidly in place to prevent displacement before concrete is placed. Hinge bracket support anchor bolts shall be coated with asphalt mastic prior to the placement of first-pour concrete. Hinge bracket support shall be connected to anchor bolts and embedded in second-pour concrete. Anchor bolts shall be prestressed as shown on contract drawings and approved field installation drawings after the concrete has attained the specified strength. A record of the prestressing operations shall be compiled and submitted.

3.1.3 Pintle Base Anchor Frame and Pintle Base

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NOTE: Design options provided in this paragraph consist of the pintle base bearing directly on an anchor frame embedded in second-pour concrete and anchored with bolts embedded in first-pour concrete, the pintle base bearing directly on second-pour concrete and anchored with bolts attached to an anchor frame embedded in first-pour concrete, and the prestressing of pintle base anchor bolts when attached to an anchor frame embedded in first-pour concrete.

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[Anchor bolts for the pintle base anchor frame shall be embedded in first-pour concrete. Submit record of the prestressing of the pintle base anchors immediately after the prestressing operations are completed. Pintle base anchor frame shall be attached to the anchor bolts, aligned, leveled, blocked rigidly to prevent displacement, and embedded in second-pour concrete. Pintle base shall be bolted to the pintle base anchor frame.] [Pintle base anchor frame shall be embedded in first-pour concrete. Pintle base shall be attached to the pintle base anchor bolts extending from the embedded anchor frame, aligned, leveled, blocked rigidly to prevent displacement, and embedded in second-pour concrete.] [Pintle base anchor bolts shall be prestressed as shown on contract drawings and approved field installation drawings. A record of the prestressing operations shall be compiled and submitted.] Concrete pours shall be allowed to set for 72 hours and must attain the specified before any loading is applied.

3.1.4 Pintle

Surfaces of the pintle base shall be cleaned thoroughly prior to installing the pintle. The pintle shaft shall be set in the pintle base and secured by lock-bolting.

3.1.5 Gate Leaf

Gate leaf components not assembled in the shop shall be assembled in the field as required for installation. Pintle socket seal retainer ring

assembly shall be attached to the pintle socket and the pintle ball shall be coated with grease prior to setting the gate leaf in place. Pintle grease pipes shall be tapped into pintle bushing in correct register with bushing grease grooves. Grease pipes shall be flushed prior to connecting to bearings. All necessary precautions shall be taken to avoid distortion of the gate leaf or any component parts. Special care shall be exercised during installation to prevent any sag of the sector gate leaf due to compression of blocking or other causes.

3.1.6 Hinge Bracket and Hinge Pin

Hinge bracket shall be attached to the hinge bracket support after the gate leaf has been set in place. Hinge pin shall be inserted to connect the hinge pin barrel of the hinge bracket to the hinge pin housing of the gate leaf. Hinge bracket shall be adjusted so that the center of the hinge pin is in vertical alignment with the center of the pintle and each gate leaf swings without interference and any point on the moving gate leaf remain in a plane throughout the range of movement.

3.1.7 Painting

Exposed parts of gates and appurtenances, except machined surfaces, corrosion-resistant surfaces, surfaces of anchorages embedded in concrete, [cathodic protection system anodes,] and other specified surfaces shall be painted as specified in Section 09 97 02 PAINTING: HYDRAULIC STRUCTURES.

3.1.8 Seal Assemblies

Rubber seal assemblies shall be installed after the embedded metal components have been concreted in place and the gate installation, including painting, completed. Rubber seals shall be fastened securely to metal retainers. Before operating the gates, a suitable lubricant shall be applied to the rubber seal rubbing plates to protect the rubber.

3.2 CATHODIC PROTECTION SYSTEM

The cathodic protection system shall conform to Section 26 42 19.10 CATHODIC PROTECTION FOR LOCK MITER GATE.

3.3 OPERATING MACHINERY

Operating machinery shall conform to Section 35 01 41.00 10 ELECTROMECHANICAL OPERATING MACHINERY FOR LOCKS.

3.4 FIELD TESTS AND INSPECTIONS

3.4.1 [Skinplate Watertightness Test

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NOTE: Skinplate watertightness tests should be deleted when complete or spot radiographic or ultrasonic examination of the skinplate is required by the specifications.

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After the gate leaves are installed but prior to painting and mounting of seals, skinplate welds shall be tested for watertightness by applying air pressure with a hose, using a minimum air pressure of 400 kPa 60 psi at the nozzle, to one face of the skinplate with a light coating of soapsuds

on the opposite face. Disclosed leaks shall be sealed with light welds.]

3.4.2 Acceptance Trial Operation

After completion of the gate installation, the Contracting Officer will examine the gates for final acceptance. The gates will be examined first to determine whether or not the workmanship conforms to the specification requirements. The Contractor will then be required to operate the gates from the fully-opened to the fully-closed position a sufficient number of times to demonstrate to the Contracting Officer's satisfaction that all parts are functioning properly. The workmanship in the fabrication and installation of gates shall be such that the gates in the closed position will form a watertight barrier across the opening. Required repairs or replacements to correct defects, as determined by the Contracting Officer, shall be made at no cost to the Government. The trial operation shall be repeated after defects are corrected. Prior to final acceptance of the gates, provide temporary restraints to prevent unauthorized operation of the gates.

3.5 PROTECTION OF FINISHED WORK

Protection of finished work shall conform to the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

-- End of Section --