UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2025
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DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

SECTION 35 20 16.39

HYDRAULIC SECTOR GATES

08/22

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USACE / NAVFAC / AFCEC | **UFGS-35 20 16.39 (August 2022)**

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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2025
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SECTION 35 20 16.39

HYDRAULIC SECTOR GATES
08/22

****
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.

Certain components of a Sector Gate may be considered fracture critical. These components may include the gudgeon hood, gudgeon anchorage, diagonals, as well as others. AWS D1.1 does not include provisions for fracture critical welding. The Designer should consider using guide specification SECTION 05 59 20 FABRICATION OF HYDRAULIC STEEL STRUCTURES for specifying fracture-critical welding utilizing a Fracture Control Plan. A Fracture Control Plan and the use of appropriate materials and welding is required by ER 1110-2-8157, "Responsibility for Hydraulic Steel Structures."

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 is to 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 is to 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 is to 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.

****

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; Errata 1 2021) 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 M6	(2024) Brands Used on Preservative Treated Materials

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	(2024) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A148/A148M	(2024) Standard Specification for Steel Castings, High Strength, for Structural Purposes
ASTM A240/A240M	(2024b) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A276/A276M	(2024) Standard Specification for Stainless Steel Bars and Shapes
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A320/A320M	(2024a) Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service
ASTM A501/A501M	(2021) 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	(2021; E 2021) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A668/A668M	(2023) Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
ASTM A709/A709M	(2024) Standard Specification for Structural Steel for Bridges
ASTM A722/A722M	(2015) Standard Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete
ASTM A992/A992M	(2022) Standard Specification for Structural Steel Shapes
ASTM B22/B22M	(2017) Standard Specification for Bronze Castings for Bridges and Turntables
ASTM B148	(2024) Standard Specification for Aluminum-Bronze Sand Castings
ASTM D256	(2010; R 2018) Standard Test Methods for Determining the Izod Pendulum Impact

	Resistance of Plastics
ASTM D395	(2016; E 2017) Standard Test Methods for Rubber Property - Compression Set
ASTM D412	(2016; R 2021) 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 D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D572	(2004; R 2019) Rubber Deterioration by Heat and Oxygen
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D792	(2013) Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness
ASTM D4020	(2011) Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials
ASTM F3125/F3125M	(2019) Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength
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 and Air Force 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.

****

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. Submittals not having a "G" or "S" classification are 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

Fabrication Drawings; G, [_____]

Shop Assembly Drawings; G, [_____]

Delivery Drawings; G, [_____]

Field Installation Drawings; G, [_____]

Stress Relieving Plan; G, [_____]

Fracture Control Plan (FCP); G, [_____]

Handling Attachments and Pick Points; G, [_____]

SD-03 Product Data

Materials

Pintle Base Anchor Frame

Pintle Base

Hinge Assembly Embedded Anchorages

SD-04 Samples

Materials; 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.

1.5 DELIVERY, STORAGE, AND HANDLING

Perform delivery, handling, and storage of materials and fabricated items in accordance with the requirements specified [herein and] in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. [Unload material and equipment delivered to the site as approved by the Contracting Officer. Verify the condition and quantity of the items delivered 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.]

1.5.1 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. Do not distort rubber seals during handling.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Design Requirements

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

2.1.1.1 Fabrication Drawings

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

2.1.1.2 Shop Assembly Drawings

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

2.1.1.3 Delivery Drawings

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

2.1.1.4 Field Installation Drawings

Provide field installation drawings showing a detailed description of the field installation procedures. Include in the description 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, to 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.

2.2 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.

2.2.1 Metals

****
NOTE: Consider the use of ASTM A709/A709M steel for fabrication of all steel components. A709 material is available in 36 and 50 ksi and provides improved toughness and maximum yield to tensile ratios to ensure ductile performance.
****

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

2.2.1.1 Structural Steel Shapes

[ASTM A36/A36M][ASTM A572/A572M][ASTM A709/A709M][ASTM A992/A992M].

2.2.1.2 Structural Steel Plates

[ASTM A36/A36M][or][ASTM A572/A572M, Grade 50][or][ASTM A709/A709M, Grade 50].

2.2.1.3 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.]

2.2.1.4 Steel Castings

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

2.2.1.5 Steel Forgings

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

2.2.1.6 High-Strength Steel Bar

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

2.2.1.7 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.

2.2.1.8 Stainless Steel Plate, Sheet, and Strip

ASTM A240/A240M, UNS [S 20910,] [S 30400,] [S 40500,]. Finish plates by hot-rolling, annealing or heat-treating, and blast-cleaning or pickling. Provide sheet and strip with No. 1 finish.

2.2.1.9 Bronze Castings

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

2.2.1.10 Aluminum-Bronze Castings

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

2.2.2 Rubber Seals

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

2.2.2.1 Physical Characteristics

Ensure seals exhibit physical characteristics that meet the following requirements:

PHYSICAL TEST	TEST VALUE	TEST METHOD SPECIFICATION
Tensile Strength	20.7 MPa3,000 psi (min.)	ASTM D412
Elongation at Break	500 percent (min.)	ASTM D412
300 percent Modulus	6.9 MPa1,000 psi (min.)	ASTM D412

PHYSICAL TEST	TEST VALUE	TEST METHOD SPECIFICATION
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, Method B
Tensile Strength (after aging 48 hrs)	80 percent tensile strength (min.)	ASTM D572

Perform the "Water Absorption" test using distilled water. Blot the washed specimen 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. Remove the specimen and allow to air cool to room temperature, and weigh the specimen. Record the weight the nearest 1 mg as M subscript 1 (M subscript 1 is defined in ASTM D471). Ensure the immersion temperature is 70 degrees C plus or minus 1 degree and the immersion duration is at least 166 hours.

[2.2.2.2 Fabrication of Rubber Seals

Provide rubber seals with a fluorocarbon film that is vulcanized and bonded to the sealing surface of the bulb. Ensure the film thickness is [0.762] [1.524] mm [0.030] [0.060] inch and is Huntington Abrasion Resistant Fluorocarbon Film No. 4508, or equal, and has the following physical properties:

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

Flush the outside surface of the bonded film with the surface of the rubber seal and ensure it is free of adhering or bonded rubber. Mold strips and corner seals 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, mask the fluorocarbon film during bonding to prevent a bond for a length sufficient to hold the film securely during testing.

]2.2.3 Bumpers and Fenders

****

NOTE: Designer should consult ERDC-CERL TR-17-37 "Material Selection for Bumpers and Fenders for Lock Gates and Guidewalls" prior to specifying Bumpers and Fenders. The designer needs to evaluate the specifics each installation prior to selecting a material. Selection should be based on relative merit in terms of selection criteria such as first cost, frequency and duration of lock closures for repairs, ability to protect the gate, ability to survive impact(s), weather resistance, maintainability and aesthetics.

****

Provide rubber bumpers and fenders designed specifically for a marine environment.

2.2.3.1 HDPE Bumpers and Fenders

Provide High Density Polyethylene (HDPE) fenders that are [_____] in color, [with four (25cm1 in) diameter fiberglass bars embedded in the fender cross section]. Ensure provided fenders include an ultraviolet stabilizer. Provide fenders with actual dimensions of [_____] by [_____] (cmin).

2.2.3.2 Timber Bumpers and Fenders

Provide timber fenders and bumpers conforming to [Douglas Fir/Douglas Fir-Larch] [No. 2 southern yellow pine], structural grade, dressed surfacing, pressure treated with waterborne preservative. Cut, beveled, or bored fenders as required before pressure treatment. Ensure all waterborne preservative treatment used is in accordance with AWPA Standard to the requirements of Use Category [UC4C for Fresh Water Use] [UC5C for Salt Water Use], except that chromated zinc chlorides, pentachlorophenol-ammoniacal systems, and alkyl ammonium compounds are not allowed. Ensure the producer brands each piece of treated lumber or timber in accordance with AWPA M6. It is the Contractor's responsibility to ensure the quality of treated wood products complies with this specification.

2.2.3.3 UHMW-PE Bumpers and Fenders

Provide composite section fender pads fabricated from ultra-high molecular weight polyethylene (UHMW-PE) plastic on top of a rubber or synthetic rubber backing. Ensure the final cross section complies with the dimensional requirements shown on the drawings. Ensure the lengths of fenders and bolting patterns also comply with the contract drawings. Cut and bevel the ultra-high molecular weight polyethylene material to the cross-sectional dimensions shown on the drawings. Provide bumpers and fenders that are yellow in color. Ensure the UHMW-PE is manufactured with a maximum of 50 percent regenerated material; and with a molecular weight of 3,000,000 to 5,000,000, in accordance with ASTM D4020, compression molded, stress relieved, and including an ultraviolet manufactured by Solidur Plastics Company, 200 Industrial Drive, Rte. 66 North, Delmont, PA 15626, or "ULTRA FEND" as manufactured by Ultra-Poly, Inc., 2926 South Steel Street, Tacoma, WA 98409 Physical characteristics of the UHMW-PE are required to meet the following:

a. Static Coefficient of Friction to Steel (Dry) - less than 0.25
b. Specific Gravity - greater than 0.92 (ASTM D792)
c. Water Absorption - do not show water absorption under long term immersion (ASTM D570)
d. Izod Impact - fender must exhibit a non-breaking condition under Izod type impact test (ASTM D256)
e. Tensile Strength - minimum break tensile strength of 4,000 psi (ASTM D638)
f. Hardness - 65-70 Durometer (ASTM D2240)

Provide extruded rubber backing materials compounded of natural or synthetic polyisoprene or a blend of both and ensure it contains reinforcing carbon black, zinc oxide, accelerators, antioxidants,

vulcanizing agents, and plasticizers.

PHYSICAL TEST	TEST VALUE	SPECIFICATION
Tensile Strength	3,000 psi (min.)	ASTM D412
Elongation at Break	450 percent (min.)	ASTM D412
300 percent Modulus	900 psi (min.)	ASTM D412
Durometer Hardness (Shore Type A)	60-70	ASTM D2240
Water Absorption	5 percent by Weight (Max.)	ASTM D471
Compression Set	30 percent (Max.)	ASTM D395
Tensile Strength (after aging 48 hr.)	80 percent (Min.)	ASTM D572

* Perform the "Water Absorption" test with distilled water. Blot the washed specimen 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. Remove the specimen, allow to cool to room temperature in air, and weigh the specimen. Record the weight to the nearest 1 mg as M subscript 1 (M subscript 1 is defined in ASTM D471). Ensure the immersion temperature is 70 degrees C plus or minus 1 degree. Perform the immersion for 166 hours. Follow the method of attaching the rubber backing to the structure as indicated on the contract drawings.

2.2.4 Asphalt Mastic

SSPC PS 9.01.

2.3 MANUFACTURED UNITS

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

2.3.1 Bolts, Nuts and Washers

Ensure high-strength bolts, nuts, and washers conform to ASTM F3125/F3125M, Grade A325, [hot-dip galvanized]. Ensure bolts, nuts, studs, stud bolts and bolting materials other than high-strength conform to ASTM A307, Grade A, [hot-dip galvanized] or ASTM A320/A320M, [Ferritic Steel, Grade [_____]] [Austenitic Steel, Grade [_____], Class [_____]]. Use bolts M16 1/2 inch and larger that have hexagon heads. Ensure the finished shank of bolts is long enough to provide full bearing. Use washer with bolts that conform to the requirements specified in the applicable specification for bolts.

2.3.2 Screws

Provide screws of the type indicated on the drawings.

2.4 FABRICATION

2.4.1 Structural Fabrication

Ensure structural fabrication conforms with the requirements shown and specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Shop-fabricate the components of the materials specified and shown. Ensure dimensional tolerances are as specified and shown. Place splices only where shown or approved. Bore pin holes in components after welding, straightening, stress-relieving, and threading operations are completed. Straighten brackets, eye bar sections, and other components requiring straightening by methods which will not damage the material. Press-fit bronze bushings with supporting components. Provide bolt connections, lugs, clips, or other pick-up assembly devices for components as shown and required for proper assembly and installation. Make provisions for the installation of appurtenances as required.

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.

2.4.2 Welding

****

NOTE: List applicable welds requiring radiographic examination.

NOTE: Specification Section 05 50 14 STRUCTURAL METAL FABRICATIONS includes welds subjected to Ultrasonic Testing (UT), Dye Penetrant Testing (PT) and Magnetic Testing (MT). AWS D1.1 does not specify nondestructive testing of any completed weld. Designer must take this into account and specify any Nondestructive Testing (NDT) requirements as well as specifying which welds are to be subjected to nondestructive testing.

The designer is to consider whether any components included are likely to be fracture critical. Fracture critical components should be identified as requiring fabrication in accordance with a Fracture Control Plan.

****

Ensure welding conforms to the requirements of AWS D1.1/D1.1M, AWS D1.2/D1.2M, the requirements specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Provide welds of the types 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, by dye penetrant, magnetic particle tests, or ultrasonic tests. All components are to be stress-relief heat treated after welding where shown. Perform stress-relieving of components prior to the attachment of miscellaneous appurtenances. Submit a Stress Relieving Plan for approval which follows the minimum requirements for thermal stress

relief in accordance with AWS D1.1.[Stress-relief heat treat all components after welding where shown. Perform stress-relieving of components prior to the attachment of miscellaneous appurtenances.][Refer to Specification SECTION 05 50 14 STRUCTURAL METAL FABRICATIONS for nondestructive testing requirements.][Submit a Fracture Control Plan (FCP) for fracture critical components.]

2.4.3 Bolted Connections

Conform to the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.4.4 Machine Work

Conform to the requirements specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.4.5 Miscellaneous Provisions

Conform to the requirements specified and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.4.6 Fabrications

Submit approved samples, prior to use of the represented materials or items in the work. Provide full size, complete samples of standard and shop fabricated items 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. Ensure fabrications conform to the following requirements.

2.4.6.1 Gate Leaf

Fabricate the gate leaf of welded members except for bolted appurtenances. Include in the gate leaf construction 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. Construct the pintle socket of cast steel conforming to ASTM A27/A27M. Press-fit pintle socket with bronze bushing conforming ASTM B22/B22M. Ensure all bearing surfaces of the bronze bushing have a truly hemispherical 0.4 micrometer 16 microinch finish. Fabricate the pipe column to conform to [ASTM A53/A53M] [ASTM A501/A501M]. Fabricate the hinge pin housing of [cast steel conforming to ASTM A27/A27M] [structural steel conforming to ASTM A36/A36M]. Fabricate trusses and vertical ribs of structural steel conforming to ASTM A36/A36M. Ensure skin plate conforms to [ASTM A36/A36M] [ASTM A572/A572M, Grade 50,]. Shop-fabricate the gate leaf. Obtain approval prior to shop-fabricating gate leaf in separate segments to facilitate handling and shipping. Show segmenting plan on approved detail drawings. Ensure such segments are constructed to permit easy field-assembly with as few sections as practicable to minimize the number of joints to be field-welded. Ensure the overall height of the gate leaf does not vary from the nominal dimension or differ from the mating gate leaf by more than 6 mm 1/4 inch. Ensure the surfaces of the vertical ribs to which skin plates are to be welded do not vary from a true plane by more than 5 mm 3/16 inch. Ensure the outside surfaces of skin plates welded to the vertical ribs do not vary from a true plane by more than 5 mm 3/16 inch. Locate splices in skin plates only where shown or approved. [In addition to welds specifically indicated on the drawings for nondestructive testing, include

non-destructive testing for [_____] 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. Obtain Contracting Officer's approval for the location of these additional welds for testing.] Provide the gate leaf complete with pintle assembly, hinge assembly, seal assembly, and other appurtenant components as required for complete installation as specified and shown.

2.4.6.2 Hinge Assembly

The hinge assembly consists of hinge bracket support anchor frame, hinge bracket support, hinge bracket, and hinge pin. Provide hinge bracket support anchor frame as a welded structural steel frame with high strength anchor bolts conforming to ASTM A722/A722M for prestressed anchorage of the hinge bracket support. Ensure hinge bracket support and hinge bracket are fabricated of [cast steel conforming to ASTM A27/A27M] [structural steel conforming to ASTM A36/A36M]. Fit the hinge pin barrel section of the hinge bracket with [a stainless steel collar conforming to ASTM A564/A564M and] [a bronze bushing conforming to ASTM B22/B22M] [an aluminum bronze bushing conforming to ASTM B148]. Fabricate the hinge pin 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, perform nondestructive testing on [_____] percent of the welds in the hinge assembly components. Obtain the location of these additional welds for testing from the Contracting Officer.] [Stress-relieve the welded hinge assembly components by heat-treating after all welding is completed. Perform stress-relieving prior to machining.]

2.4.6.3 Pintle Assembly

The pintle assembly consists of pintle base anchor frame, pintle base, pintle socket seal retainer ring assembly, pintle, and pintle socket which are integral component of the gate leaf. Fabricate pintle base anchor frame as a welded structural steel frame [with high strength anchor bolts conforming to ASTM A722/A722M for prestressed anchorage of the pintle base]. Fabricate the pintle base of [cast steel conforming to ASTM A27/A27M] [structural steel conforming to ASTM A36/A36M]. Fabricate the pintle 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]. Finish the pintle ball pintle with a 0.4 micrometer 16 microinch finish and that is 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. Match-mark the pintle ball with the bushing when fitted and so erected in the field.

2.4.6.4 Seal Assemblies

Provide seal assemblies consisting of rubber seals, stainless steel retainer and spacer bars, and fasteners. Ensure rubber seals are continuous over the full length. Fit and drill seals accurately fitted and drilled for proper installation. Drill bolt holes drilled in the rubber seals by using prepared templates or the retainer bars as templates. Fully mold splices in seals to develop a minimum tensile strength of 50 percent of the unspliced seal, and only at locations shown. Shop vulcanize all splices. Locate vulcanized splices between molded corners and straight lengths as close to the corners as

practicable. Bevel splices on a 45 degree bevel related to the "thickness" of the seal. Finish the surfaces of splices smooth and free of irregularities. Field-splice stainless steel retainer bars only where shown and machine-finished them after splicing.

2.4.6.5 Appurtenant Items

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

2.4.7 Shop Assembly

Ensure shop assembly requirements for sector gates and appurtenant items are as shown and specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Completely shop assemble sector gates and appurtenant items, unless otherwise approved, to assure satisfactory field installation. Fit and bolt adjoining components together to facilitate field connections. Carefully preserve the match-marking of unassembled items until the items are assembled. Cover mating surfaces and machined surfaces with a rust preventive until assembly. Shop-weld assembled components in their final positions as much as delivery and field installation conditions will permit. Fit and drill rubber seals to match the seal retainers, match-marked, and removed for shipment. Perform shop assembly and disassembly in the presence of the Contracting Officer unless otherwise approved. Contractor's responsibilities under this contract are unaffected by the presence of the Contracting Officer.

2.5 COMPONENTS

2.5.1 Cathodic Protection System

conform the cathodic protection system to Section 26 42 19.00 10 CATHODIC PROTECTION SYSTEMS (IMPRESSED CURRENT)FOR LOCK MITER GATES.

2.5.2 Operating Machinery

Conform operating machinery to Section 35 01 41.00 10 ELECTROMECHANICAL OPERATING MACHINERY FOR LOCKS AND DAMS.

2.6 TESTS, INSPECTIONS, AND VERIFICATIONS

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

2.6.1 General

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

[2.6.2 Testing of Rubber Seals

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

Test the fluorocarbon film of rubber seals for adhesion bond in accordance

with ASTM D413 using either the machine method or the deadweight method. Cut a 25 mm 1 inch long piece of seal from the end of the seal which has been masked and subjected to tension at an angle approximately 90 degrees to the rubber surface. Ensure there is 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

Installation per the requirements specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Assemble miter gates and appurtenant items for installation in strict accordance with the contract drawings, approved installation drawings, and shop match-markings. Thoroughly clean and lubricate bearing surfaces requiring lubrication with an approved lubricant before assembly and installation. Ensure components to be field-welded are placed in correct alignment before welding is commenced. Design and submit Handling Attachments and Pick Points required to be added to any specified items herein prior to installation.

3.1.1 Embedded Metals

Accurately install sill assemblies, seal plates, frames, bases and other embedded metal items required for proper and complete installation to the alignment and grade required to ensure accurate fitting and matching of components. Primer coat all embedded metals with the required paint on all surfaces prior to installation in concrete forms. Install anchors for embedded metals as shown. Attach items requiring two concrete pours for installation to the embedded anchors after the initial pour, adjusted to the proper alignment, and concreted in place with the second pour. Grind smooth welded field splices in sealing surfaces of embedded items.

3.1.2 Hinge Assembly Embedded Anchorages

Submit record of the prestressing of hinge bracket anchors immediately after completion of the prestressing operations. Accurately align, level, and rigidly block in place the hinge assembly embedded anchorages consisting of the hinge bracket support anchor frame and attached hinge bracket support anchor bolts in a manner to prevent displacement before concrete is placed. Coat hinge bracket support anchor bolts with asphalt mastic prior to the placement of first-pour concrete. Connect the hinge bracket support to anchor bolts and embed in second-pour concrete. Prestress anchor bolts as shown on contract drawings and approved field installation drawings after the concrete has attained the specified strength. Compile and submit a record of the prestressing operations to

the Contracting Officer.

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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[Embed anchor bolts for the pintle base anchor frame in first-pour concrete. Submit record of the prestressing of the pintle base anchors immediately after the prestressing operations are completed. Attach the pintle base anchor frame to the anchor bolts, align, level, and block rigidly to prevent displacement, and embedded in second-pour concrete. Bolt pintle base to the pintle base anchor frame.] [Embed pintle base anchor frame in first-pour concrete. Attach pintle base to the pintle base anchor bolts extending from the embedded anchor frame, align, level, block rigidly to prevent displacement, and embed in second-pour concrete.] [Prestress pintle base anchor bolts as shown on contract drawings and approved field installation drawings. Compile and submit a record of the prestressing operations.] Allow concrete pours to set for 72 hours and ensure the specified strength has been attained before any loading is applied.

3.1.4 Pintle

Thoroughly clean the surfaces of the pintle base prior to installing the pintle. Set the pintle shaft in the pintle base and secure by lock-bolting.

3.1.5 Gate Leaf

Field-assemble gate leaf components not assembled in the shop as required for installation. Attach pintle socket seal retainer ring assembly to the pintle socket and coat the pintle ball with grease prior to setting the gate leaf in place. Tap pintle grease pipes into pintle bushing in correct register with bushing grease grooves. Flush grease pipes prior to connecting to bearings. Take all necessary precautions to avoid distortion of the gate leaf or any component parts. Exercise special care 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

Attach the hinge bracket to the hinge bracket support after the gate leaf has been set in place. Insert the hinge pin to connect the hinge pin barrel of the hinge bracket to the hinge pin housing of the gate leaf. Adjust the hinge bracket 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

Paint 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 as specified in Section 09 97 02 PAINTING: HYDRAULIC STRUCTURES.

3.1.8 Seal Assemblies

Install rubber seal assemblies after the embedded metal components have been concreted in place and the gate installation, including painting, completed. Fasten the rubber seals securely to metal retainers. Before operating the gates, apply a suitable lubricant to the rubber seal rubbing plates to protect the rubber.

3.2 FIELD QUALITY CONTROL

Non-Destructive Testing of field welds is required to meet the same quality control requirements as shop-welded components.

3.3 SYSTEM START-UP

3.3.1 Trial Operation

After completion of the gate installation, conduct an examination of the gates in the presence of the Contracting Officer for final acceptance. First examine the gates to determine whether or not the workmanship conforms to the specification requirements. 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 is the result in a condition where when the gates are in the closed position watertight barrier is formed across the opening. The contractor is required to make all repairs or replacements to correct defects, as determined by the Contracting Officer, at no cost to the Government. Repeat the trial operation after defects are corrected. Prior to final acceptance of the gates, provide temporary restraints to prevent unauthorized operation of the gates.

3.4 PROTECTION

Protect finished work in conformance with the requirements of Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

-- End of Section --