UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION TABLE OF CONTENTS

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

SECTION 35 20 16.33

MITER GATES

01/08

PART 1 GENERAL

1.1 UNIT PRICES
1.1.1 Furnishing and Installing Miter Gates
1.1.1.1 Payment
1.1.1.2 Unit of Measure
1.1.2 Furnishing Miter Gates
1.1.2.1 Payment
1.1.2.2 Unit of Measure
1.1.3 Installing Miter Gates
1.1.3.1 Payment
1.1.3.2 Unit of Measure
1.2 REFERENCES
1.3 SUBMITTALS
1.4 QUALITY ASSURANCE
1.4.1 Qualification of Welders
1.4.2 [Safety Provisions for Zinc Filler
1.4.3 Detail Drawings
1.4.3.1 Fabrication Drawings
1.4.3.2 Shop Assembly Drawings
1.4.3.3 Delivery Drawings
1.4.3.4 Field Installation Drawings
1.5 DELIVERY, STORAGE, AND HANDLING
1.5.1 Rubber Seals
1.5.2 [Epoxy Filler

PART 2 PRODUCTS

2.1 MATERIALS
2.1.1 Metals
2.1.1.1 Structural Steel
2.1.1.2 Structural Steel Plates
2.1.1.3 Steel Pipe
2.1.1.4 Stainless Steel Bars and Shapes
2.1.1.5 Stainless Steel Plate, Sheet, and Strip
2.1.2 Rubber Seals

2.1.2.1 Physical Characteristics
2.1.2.2 [Fabrication
2.1.3 Epoxy Filler
2.1.4 Zinc Filler
2.1.5 Bumpers and Fenders
2.1.6 Asphalt Saturated Preformed Filler Strips
2.1.7 Asphalt Cement
2.1.8 Asphalt Mastic
2.2 MANUFACTURED UNITS
2.2.1 Bolts, Nuts and Washers
2.2.2 Screws
2.3 FABRICATION
2.3.1 Structural Fabrication
2.3.2 Welding
2.3.3 Bolted Connections
2.3.4 Machine Work
2.3.5 Miscellaneous Provisions
2.3.6 Fabrications
2.3.6.1 Gate Leaf
2.3.6.2 Wall Quoin
2.3.6.3 Quoin and Miter Contact [Blocks] [Posts]
2.3.6.4 Pintle Assembly
2.3.6.5 Gudgeon Anchorage
2.3.6.6 Seal Assemblies
2.3.6.7 Appurtenant Items
2.3.7 Shop Assembly
2.4 TESTS, INSPECTIONS, AND VERIFICATIONS
2.4.1 General
2.4.2 Testing of Rubber Seals

PART 3 EXECUTION

3.1 INSTALLATION
3.1.1 Embedded Metals
3.1.2 Pintle Assembly
3.1.3 Gudgeon Embedded Anchorage
3.1.4 Wall Quoin
3.1.5 Gate Leaf
3.1.6 Diagonals
3.1.7 Gate Leaf Quoin and Miter Contact [Blocks] [Posts]
3.1.7.1 Placing [Epoxy] [Zinc] Filler
3.1.7.2 Adjusting Contact [Blocks] [Posts]
3.1.8 Miter Guide
3.1.9 Painting
3.1.10 Seal Assemblies
3.2 CATHODIC PROTECTION SYSTEM
3.3 OPERATING MACHINERY
3.4 FIELD TESTS AND INSPECTIONS
3.4.1 [Skin Plate Watertightness Test
3.4.2 Acceptance Trial Operation
3.5 PROTECTION OF FINISHED WORK

-- End of Section Table of Contents --

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USACE / NAVFAC / AFCEC / NASA | **UFGS-35 20 16.33 (January 2008)**

Preparing Activity: USACE | **Superseding UFGS-35 20 16.33 (April 2006)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

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SECTION 35 20 16.33

MITER GATES

01/08

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NOTE: This guide specification covers the requirements for the fabrication, assembly, delivery, and installation of miter gates and appurtenant items as specified and shown. 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 Miter Gates

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

1.1.1.1 Payment

Payment will be made for costs associated with furnishing and installing miter gates and appurtenant items, which includes full compensation for the materials, fabrication, delivery, installation, and testing of miter gates and appurtenant items including gate leaves, diagonals, strut connections, miter guides, miter latches, recess latch strikes, quoin and miter contact blocks, gudgeon top anchorages, pintle assemblies, [walkways,] [bridgeways,] gudgeon embedded anchorages, wall quoins, sill assemblies, seal assemblies, recess latches, bumpers, fenders, and all other items necessary for complete installation.

1.1.1.2 Unit of Measure

Unit of measure: lump sum.

1.1.2 Furnishing Miter Gates

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

1.1.2.1 Payment

Payment will be made for costs associated with furnishing miter gates and appurtenant items, which includes full compensation for the materials, fabrication, and delivery of miter gates and appurtenant items including gate leaves, diagonals, strut connections, miter guides, miter latches, recess latch strikes, quoin and miter contact blocks, gudgeon top anchorages, pintle assemblies, [walkways,] [bridgeways,] gudgeon embedded anchorages, wall quoins, sill assemblies, seal assemblies, recess latches, 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 Miter Gates

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

1.1.3.1 Payment

Payment will be made for costs associated with the installation of miter gates and appurtenant items, which includes full compensation for the complete installation and testing of miter 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 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 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 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 B6	(2018) Standard Specification for Zinc
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 D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness
ASTM D3019	(2008) Lap Cement Used with Asphalt Roll Roofing Non Fibered, Asbestos Fibered, and Non Asbestos Fibered

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[, [_____]]

Diagonals Prestressing; G[, [_____]]

Gudgeon Embedded Anchorage; G[, [_____]]

SD-03 Product Data

Materials

Diagonals Prestressing

Gudgeon Embedded Anchorage

Welding

SD-04 Samples

Materials; G[, [_____]]

SD-06 Test Reports

Tests, Inspections, and Verifications

SD-07 Certificates

Epoxy Filler

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 [Safety Provisions for Zinc Filler

The following special safety provisions are required for heating and placing zinc filler:

a. Workers shall wear protective clothing including hard hats with fine wire mesh screen, goggles, leather sleeves, chaps, apron, and leather gloves.

b. Workers shall wear air-line respirators certified by National Institute for Occupational Safety and Health (NIOSH) or Mine Safety and Health Administration (MSHA). In enclosed spaces, both local exhaust ventilation and air-line respirators are required. Local exhaust ventilation shall consist of movable hoods placed close to the work to remove fumes at the source.

c. Ladles, equipment, and material shall be pre-heated before being used so that they will be moisture-free.

d. Heating devices and ladles shall be placed on a level, firm foundation, and protected against traffic, accidental tipping, or similar hazard.

e. Hot zinc shall not be carried up or down ladders.

f. Buckets or vessels used for handling and transporting hot zinc shall be substantially constructed and shall not be filled higher than 100 mm 4 inches from the top.]

1.4.3 Detail Drawings

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.

1.4.3.1 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.

1.4.3.2 Shop Assembly Drawings

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

1.4.3.3 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.

1.4.3.4 Field Installation Drawings

Show on the field installation drawings 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 gate leaf diagonals, which shall include descriptions of connections, riggings, anchorages, and measuring equipment; methods for installing quoin and miter blocks, including checking and maintaining alignments of the blocks

during concreting and placement of [epoxy] [zinc] filler; [procedures and equipment used for heating and placing of the zinc filler;] and methods for installing other appurtenant items.

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. [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.]

1.5.1 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.

1.5.2 [Epoxy Filler

Deliver epoxy filler from the manufacturer just prior to use in the work to insure receipt of recently manufactured material and store under cover, out of direct sunlight, at a temperature between 20 to 30 degrees C 65 to 85 degrees F.]

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. Materials orders, materials lists and materials shipping bills shall conform with the requirements of Section 05 50 14 STRUCTURAL METAL 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.

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

Structural steel shall conform to ASTM A36/A36M.

2.1.1.2 Structural Steel Plates

Structural steel plates shall conform to [ASTM A36/A36M] [ASTM A572/A572M, Grade 50] [ASTM A588/A588M, Grade 50].

2.1.1.3 Steel Pipe

Steel pipe shall conform to ASTM A53/A53M, Type S, Grade B, seamless, black, nominal size and weight class or outside diameter and nominal wall thickness as shown, [plain] [threaded] [threaded and coupled] ends.

2.1.1.4 Stainless Steel Bars and Shapes

Stainless steel bars and shapes shall conform to 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.

2.1.1.5 Stainless Steel Plate, Sheet, and Strip

Stainless steel plate, sheet, and strip shall conform to 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.

2.1.2 Rubber Seals

****
NOTE: If fluorocarbon (Teflon) clad seals are not used, omit paragraphs FABRICATION and ZINC FILLER.
****

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 MPa2,500 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

PHYSICAL TEST	TEST VALUE	TEST METHOD SPECIFICATION
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 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 Epoxy Filler

Epoxy filler shall be an approved epoxy resin formulation equal to "Nordback," a product of Nordberg Mfg. Co., or an approved equal, with a specific gravity of 1.70 to 1.75, minimum compressive strength after 72 hours at 20 degrees C 70 degrees F of 114 MPa 16,500 psi, and maximum shrinkage of 0.15 percent. Submit Manufacturer's certificate for epoxy filler stating that it meets or exceeds the specified physical properties; material shall be delivered to the site.

][2.1.4 Zinc Filler

ASTM B6.

]2.1.5 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.]

2.1.6 Asphalt Saturated Preformed Filler Strips

ASTM D1751.

2.1.7 Asphalt Cement

ASTM D3019.

2.1.8 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 herein 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 on the drawings. 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 [cathodic protection system devices and other] appurtenances as required.

2.3.2 Welding

****

NOTE: List applicable welds requiring radiographic

examination.
****

Welding shall conform with 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. 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, 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 herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.3.6 Fabrications

2.3.6.1 Gate Leaf

Gate leaf shall be of welded structural steel fabrication consisting of horizontal girders, [vertical beams,] [vertical girders,] intercostals, diaphragms, quoin post, gudgeon pin hood, operating strut connections, skin plate, and adjustable diagonals. Gate leaf shall be shop-fabricated. Contractor proposed shop-fabrication of gate leaf in separate segments to facilitate handling and shipping must be approved by the Contracting Officer 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 framing elements 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 framing members 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 girders, gudgeon pin hood, verticals and skin plate of the gate leaf 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 quoin and miter contact [blocks] [posts], miter guide assembly, pintle assembly, gudgeon

anchorage, seal assembly, and other appurtenant components as required for complete installation, specified herein and shown.

2.3.6.2 Wall Quoin

Wall quoin shall consist of a welded structural steel frame with adjustable stainless steel base anchors and adjustable stainless steel quoin contact [block] [post].

2.3.6.3 Quoin and Miter Contact [Blocks] [Posts]

Quoin and miter contact [blocks] [posts] shall be of stainless steel bars conforming to ASTM A276/A276M or ASTM A564/A564M. Splices in contact [blocks] [posts] shall be made by an offset method so that there will not be a continuous joint across the [block] [post]. [Splices in gate leaf contact [block] [post] shall occur only at the centerlines of horizontal girders.] Splice locations shall match those of the opposing [block] [post]. Contact faces of contact [blocks] [posts] shall be milled at splices to assure watertight joints. Contact [blocks] [posts] shall be provided with adjusting bolts as shown.

2.3.6.4 Pintle Assembly

Pintle assembly shall consist of pintle socket, pintle, and pintle base as shown. Pintle socket shall be of cast nickel-alloy steel. Pintle socket shall be press-fitted with an aluminum bronze bushing with bearing surfaces finished truly hemispherical. Pintle shall be of [cast alloy] [forged alloy] steel with bearing surfaces of corrosion-resisting steel. Pintle ball shall receive a 0.4 micrometer 16 microinch finish and shall be fitted into the bushing by scraping 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. Pintle base shall be of cast steel. Bolt holes for attaching pintle socket to gate leaf shall be drilled and reamed after the pintle socket is assembled with gate leaf. Pintle socket shall be connected to the bottom of the lower girder web of the gate leaf with stainless steel bolts.

2.3.6.5 Gudgeon Anchorage

Gudgeon anchorage shall consist of gudgeon pin barrel, gudgeon anchorage links, gudgeon pin, and gudgeon embedded anchorage. Gudgeon pin barrel shall be of welded [structural steel plates] [forged alloy steel plates conforming to ASTM A668/A668M] and shall be fitted with a bronze bushing. Gudgeon anchorage links and gudgeon pin shall be of forged alloy steel conforming to ASTM A668/A668M. Gudgeon anchorage links shall be pin connected to the gudgeon embedded anchorage and shall have a threaded section for adjustment of the gate leaf. The threaded section shall have right and left threads, a hexagonal sleeve nut with 13 mm1/2 inch threads, and a jam nut with standard threads at each end of the sleeve nut. The gudgeon embedded anchorage shall consist of a structural steel frame with end-restrained anchor bolts conforming to [ASTM A325M. ASTM A325.] [ASTM A490M. ASTM A490M.]

2.3.6.6 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 machine-finished after splicing.

2.3.6.7 Appurtenant Items

Sill assemblies, latches, bumpers fenders, seal plates and shapes, and other appurtenant items shall conform to details specified and shown.

2.3.7 Shop Assembly

Shop assembly requirements for miter gates and appurtenant items shall be as shown and specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Miter gates and appurtenant items shall be assembled completely in the shop, unless otherwise approved by the Contracting Officer, 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 by the Contracting Officer. 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 herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

2.4.2 Testing of Rubber Seals

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
0.762 mm0.030 inch	13.6 kg per 25 mm30 pounds per inch width	13.6 kg per 25 mm30 pounds per inch width
1.524 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 shall conform with the requirements specified herein and in Section 05 50 14 STRUCTURAL METAL FABRICATIONS. Miter 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

Sill assemblies, 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 Pintle Assembly

Base anchors for the pintle assembly shall be embedded in first-pour concrete. The pintle assembly base plate shall be attached to base anchors, adjusted to the exact elevation and center-to-center distance shown, leveled, blocked rigidly to prevent displacement, and embedded in second-pour concrete. The concrete shall be allowed to set 72 hours and must reach a minimum compressive strength of [_____] MPa psi before loading is applied. [The space in the floating pintle base not occupied by the pintle shoe shall be filled completely with sponge rubber before the gate leaf is set in place.]

3.1.3 Gudgeon Embedded Anchorage

Submit approved gudgeon embedded anchorage prestressing plan prior to initiating the anchorage operations. Gudgeon embedded anchorage prestressing record prior to completion of the contract. The gudgeon embedded anchorage, except for anchor bolts and horizontal anchor arms, shall be covered with asphalt saturated preformed strips applied with asphalt cement prior to being embedded in concrete. Anchor bolts shall be coated with asphalt mastic. The gudgeon embedded anchorage shall be aligned, leveled, and blocked rigidly in place to prevent displacement before concrete is placed. Concrete shall be placed in a manner not to damage the preformed strips. Anchor bolts shall be prestressed after the concrete has attained the specified strength in accordance with contract

drawings and approved field installation drawings. A record of the gudgeon embedded anchorage prestressing operations shall be compiled and submitted immediately after completion of the prestressing operations.

3.1.4 Wall Quoin

Base anchors for the wall quoin shall be embedded in first-pour concrete. The wall quoin shall be attached to base anchors prior to setting the gate leaf in place. After the gate leaf is set in place, the wall quoin shall be plumbed and adjusted in relation to the gate leaf quoin so as to provide for continuous contact between the sealing surfaces of the wall and gate leaf quoin contact [blocks] [posts] over the full height of the gate leaf. This adjustment shall be made almost entirely by moving the wall quoin so that the gap for the [epoxy] [zinc] filler behind the gate leaf quoin contact [block] [post] remains near the nominal dimension. After final adjustments have been made, the wall quoin shall be anchored firmly and the second-pour concrete shall be placed in the blockout.

3.1.5 Gate Leaf

Gate leaf components not assembled in the shop shall be assembled in the field as required for installation. 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 miter ends of the gate leaf due to compression of blocking or other causes. After the gate leaf has been set in place and the components of gudgeon anchorage are connected to the gate leaf, the gate leaf shall be plumbed and brought into correct position by adjusting the sleeve nuts of the diagonals and the gudgeon anchorage links.

3.1.6 Diagonals

Gate leaf diagonals shall be attached to the gate leaf after the leaf is set in place. Diagonals prestressing shall be performed before the final adjustment of the quoin and miter contact [blocks] [post] are made. Prestressing of diagonals shall be as specified, shown, and as approved on the prestressing plan developed by the Contractor. Submit approved diagonal prestressing plan prior to initiating the prestressing operations. Submit diagonal prestressing records immediately after completion of the prestressing operations. The plan for prestressing the diagonals shall describe the method of prestressing, including the materials, connections, rigging, anchorages, and stress measuring equipment. Compile a record of the prestressing operations consisting of the information indicated in the following table:

STRESS DATA TABLE					
Gate Leaf Location:				Date:	
	1	2	3	4	5
Diagonal	Strain Gage Initial	Readings Final	E (mm)(in.)	D (mm)(in.)	d (mm)(in.)

STRESS DATA TABLE					
[_____]	[_____]	[_____]	[_____]	[_____]	[_____]
[_____]	[_____]	[_____]	[_____]	[_____]	[_____]
[_____]	[_____]	[_____]	[_____]	[_____]	[_____]

1. Initial strain gage readings shall be made after slack is removed.

2. Final strain gage readings shall be made after prestressing is complete.

3. E is the total elongation over the full length of the diagonal, computed from the strain gage readings.

4. D is the prestress deflection of the leaf as shown on the drawings.

5. d is the field deflection of the leaf measured after completion of the prestress operation; it is the deflection when final strain gage readings are taken.

3.1.7 Gate Leaf Quoin and Miter Contact [Blocks] [Posts]

After the wall quoin has been adjusted and concreted in place and final adjustments made to the gudgeon anchorage links, gate leaf quoin and miter contact [blocks] [posts] shall be adjusted to provide continuous contact over the full height of the gate leaf in the mitered position. After the gate leaf diagonals are prestressed and final adjustments of gate leaf quoin and miter contact [blocks] [posts] have been made with the gate leaf in the mitered position, the gate leaf shall be swung out of miter and [epoxy] [zinc] filler poured behind the quoin and miter contact [blocks] [posts]. Prior to pouring of the filler, the surfaces to receive the filler shall be cleaned free of dirt, rust, and other foreign materials. The adjusting and holding bolts shall be coated with grease or other bond breaker to prevent adherence of the filler.

3.1.7.1 Placing [Epoxy] [Zinc] Filler

[A field test to determine the indentation hardness of the epoxy filler compound shall be conducted prior to placement. The field test procedures are as follows:

a. Cast a 50 mm 2 inch cube sample of mixed epoxy filler compound in a mold and cure at room temperature (20 to 25 degrees C 70 to 80 degrees F) for 24 plus or minus 8 hours.

b. Remove from mold and cut sample to expose interior surface.

c. Sand exposed interior surfaces to remove saw marks and provide a smooth surface.

d. Using a Type D Durometer conforming to ASTM D2240, measure the hardness across the exposed interior surface, taking a minimum of three readings on each half of the sample. Care must be taken during the durometer reading to insure the spring loaded pin used to penetrate the surface is not in a depressed surface caused by either residual saw marks or an exposed air bubble. The average reading

should be at least 85, with no individual reading below 82. If the durometer readings fall below the required minimum values, the material will be rejected.

The manufacturer's instructions for placing the epoxy filler shall be followed explicitly. Special precautions must be taken to prevent leakage of the filler during placement. The complete masses of the metals whose surface areas are to receive the epoxy filler should have a temperature of 15 to 30 degrees C 60 to 90 degrees F. The epoxy filler shall be kept free from moisture or other foreign materials during mixing and placement and for at least 48 hours after placement.]

[Immediately preceding the pouring of the zinc filler, the adjacent metal components shall be pre-heated to a temperature of 100 to 150 degrees C212 to 300 degrees F by an approved method which does not buckle the metal components. The zinc filler shall then be poured at a temperature which will insure that it will completely fill all interstices. Pouring temperature of zinc filler shall be maintained between 430 and 480 degrees C 810 and 900 degrees F to minimize volatilization and oxidation of the zinc.]

3.1.7.2 Adjusting Contact [Blocks] [Posts]

After the [epoxy has set] [zinc has cooled], quoin and miter contact [blocks] [posts] shall be drawn up against the filler by tightening of the adjusting bolts. After the contact [blocks] [posts] are adjusted, the gate leaves shall swing into the mitered position without interference of the quoin contact [blocks] [posts] and the gate leaf quoin contact [block] [post] shall make tight contact with the wall quoin contact [block] [post].

3.1.8 Miter Guide

Miter guide shall be installed after the contact [blocks] [posts] have been properly set. The guide bracket and roller bracket shall be mounted on gate leaves with leaves in the mitered position. The roller shall be centered accurately in the saddle of the contact [blocks] [posts] and shall be in full contact with the [blocks] [posts]. Adjustment of the miter guide shall be accomplished by adjusting the guide bracket and roller bracket so that the gap behind the contact [blocks] [posts] for the [epoxy] [zinc] filler is kept at the nominal dimension. Proper adjustment of the brackets should allow either gate leaf to be mitered or opened without moving the other leaf. After final adjustments have been made, bolt holes shall be drilled in the brackets and gate leaves, brackets shall be bolted securely in place, and [epoxy] [zinc] filler shall be placed behind the contact [blocks] [posts].

3.1.9 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.

3.1.10 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 gate(s), 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 SYSTEMS FOR LOCK MITER GATES.

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 [Skin Plate Watertightness Test

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NOTE: Skin plate watertightness tests should not be required when complete or spot radiographic or ultrasonic examination of the skinplate is required by the specifications.

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After the gate leaf diagonals are prestressed but prior to painting and mounting of seals, skin plate 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 skin plate 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 --